PROCEEDINGS

Fifty-Fifth Annual Convention

OF THE

American Railway Bridge and Building Association

1950

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Proceedings of the

Fifty-Fifth Annual Convention

OF THE

American Railway Bridge and Building Association

Held at

CHICAGO, ILLINOIS

September 18-20, 1950

Published by the Association
Elise LaChance, Secretary
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W. F. Martens ..... President
Atchison, Topeka & Santa Fe, San Bernardino, Cal.

W. A. Huckstep ..... First Vice-President
Missouri Pacific, St. Louis Mo.

Guy E. Martin ..... Second Vice-President
Illinois Central, Chicago

F. R. Spofford ..... Third Vice-President
Boston & Maine, Dover, N. H.

Lee Mayfield ..... Fourth Vice-President
Missouri Pacific, Houston, Tex.

Elise LaChance ..... Secretary
431 S. Dearborn, Chicago

L. C. Winkelhaus ..... Treasurer
Chicago & North Western, Chicago

The Executive Committee Consists of the Officers and the Following:

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M. H. Dick, Railway Engineering and Maintenance ..... Chicago

R. R. Gunderson, Southern ..... Washington, D.C.

J. F. Warrenfells, Seaboard Air Line ..... Savannah, Ga.

Past President

W. F. Martens, Atchison, Topeka & Santa Fe ..... San Bernardino, Cal.

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PROCEEDINGS

This section contains a running story of the activities during the three-day annual meeting in 1950; brief abstracts of the addresses read to the joint sessions with the Roadmasters' Association; and all of the B. & B. committee reports, printed in full, with brief abstracts of the discussions that followed their presentation.

Many railway supervisory officers with jurisdiction over the maintenance of bridges and buildings were given new slants on old problems during the fifty-fifth annual convention of the American Railway Bridge & Building Association, which was held at the Stevens hotel, Chicago, September 18-20. This came about largely through presentation of seven technical committee reports that were devoted in large part to the discussion of modern ways of dealing with problems that have existed for a long time. Continuing the practice started in 1946 this meeting was held concurrently with the annual convention of the Roadmasters' and Maintenance of Way Association. The two meetings convened in a joint session on Monday morning, September 18, after which the two groups separated to hold individual sessions. However, they reconvened in another joint session on Tuesday afternoon to hear three addresses on subjects of mutual interest.

One of the most significant features of these conventions was the magnitude of the attendance which was of record proportions. During the three-day period a total of 897 members of the two associations and 262 guests registered at the meetings, the aggregate attendance being 1,159 members and guests. This compares with a registration of 808 members and guests in 1949, and 900 members and guests at the 1948 meeting, the latter figure constituting the previous high record. Doubtless contributing in an important measure to the large attendance was the record display of manufacturers' products that was on view at the Coliseum during the meetings. This exhibit was sponsored jointly by the Track Supply Association and the Bridge and Building Supply Men's Association. Products of 122 manufacturers were on display in 250 booths. The two supply associations were also hosts to the members of the two railroad groups and their families at a banquet on Tuesday evening, which was attended by 1596 persons.

Presiding jointly over the combined opening session on Monday morning were W. F. Martens, general foreman bridges and buildings, Atchison, Topeka & Santa Fe, San Bernardino, Cal., and president of the Bridge and Building Association, and A. G. Reese, district maintenance engineer of the Chicago, Burlington & Quincy, Galesburg, Ill., and president of the Roadmaster' group.

The separate sessions of the Bridge & Building Association were directed by Mr. Martens, assisted by W. A. Huckstep, general building supervisor of the Missouri Pacific, St. Louis, Mo., and first vice-president of the association.

At the opening session the principal address was made by J. H. Aydelott, vice-president, Operations and Maintenance department, Association of American Railroads. Words of greeting were also heard during this session from H. S. Loeffler, assistant chief engineer, Great Northern, St. Paul, Minn. and president of the American Railway Engineering Association; from Kenneth Cavins, president of the Track Supply Association; from G. R. Betts, president of the Bridge and Building Supply Men's Association; and from Lewis Thomas, secretary of the Track Supply Association and director of exhibits for both of the supply groups.

The opening feature of the first separate session of the Bridge & Building group was an address by President Martens in which, in addition to giving an account of his stewardship of the association's affairs, he urged the members to cooperate with the railroad industry in its program to win the good will of the public. The association, through its members, said Mr. Martens, "can exercise a considerable influence towards guiding our railroads along the road to popular acclaim." As a prerequisite to success-

ful action on this score "it is imperative," said Mr. Martens, "that the members themselves become thoroughly familiar with the subject." Success in winning public sympathy also depends on salesmanship, and he urged the individual members to become salesmen for railroad service. Mr. Martens also said that we must "forget our own personal ambitions and desires and look only to the good of the organization and the enterprise that provides us with a livelihood."

Another event at the opening session of the Bridge & Building meeting was the election of two new honorary members—A. E. Bechtelheimer, engineer of bridges (retired), Chicago & North Western, and T. H. Strate, division engineer (retired), Chicago, Milwaukee, St. Paul & Pacific.

The principal business conducted at the meeting consisted of the presentation and consideration of seven committee reports on the following subjects: Types of Treated Lumber and Uses in Building Maintenance and Construction; Construction and Maintenance of Station Platforms; How to Sell Accident Prevention to the Man in the Gang; Installing and Maintaining Waterproofing on Ballast-Deck Bridges; Mechanization and Specialization of Forces; Concrete Piles in Bridge and Pier Construction; and External Protection from Corrosion for Pipe Lines.

The first speaker on the program of the joint session on Tuesday afternoon was J. P. Newell, general manager, Pennsylvania, western region, Chicago, whose subject was The Role of Supervision in the Present World Crisis. He was followed on the program by L. W. Horning, vice-president, personnel and public relations, New York Central System, who spoke on Personnel Relations As An Aid to Greater Efficiency. Following Mr. Horning came L. B. Harper, personnel assistant, Illinois Central, Chicago, whose subject was The Supervisor's Approach to the Safety Problem.

After the close of the business session Wednesday noon, September 20, about 60 of those present participated in a bus trip to inspect the new laboratories of the Portland Cement Association at Skokie, Ill. At the laboratories the group, along with other guests, witnessed the testing to failure of a prestressed concrete trestle slab.

In the election of officers at the final business session Mr. Huckstep was advanced to president; Guy E. Martin, superintendent of water service, Illnois Central, Chicago, was promoted from second vice-president to first vice-president; F. R. Spofford, assistant division engineer, Boston & Maine, Dover, N. H., was advanced from third vice-president to second vice-president; Lee Mayfield, resident engineer, Missouri Pacific, Houston, Tex., was promoted from fourth vice-president to third vice-president; and H. M. Harlow, assistant general supervisor bridges and buildings, Chesapeake & Ohio, Richmond, Va., was elected fourth vice-president. L. C. Winkelhaus, architectural engineer, Chicago & North Western, Chicago, was re-elected treasurer. Directors elected were: R. R. Gunderson, assistant bridge engineer, Southern, Washington, D. C.; J. F. Warrenfells, master carpenter, Seaboard Air Line, Savannah, Ga.; and Merwin H. Dick, editor, Railway Engineering and Maintenance, Chicago.

Eight subjects were chosen for investigation during the ensuing year. These subjects are as follows:

(1) Fire Protection of Structures and Materials.
(2) Accident Prevention in Maintenance and Use of Work Equipment.
(3) Developments in Use of Laminated Timbers.
(4) Protection of Steel Bridges Against Brine Drippings.
(5) Comparative Economies of Materials for Building Exteriors.
(6) Construction and Maintenance of Diesel Fueling Facilities.
(7) Effects of the 40-Hr. Week on B. & B. Maintenance.
(8) Economies in Maintenance and Operation of Heating Plants.

Abstracts of the addresses by Messrs. Aydelott, Newell, Horning and Harper, as delivered before the joint sessions, are presented below, followed by the Committee reports in full, with brief abstracts of the discussions from the floor.

Problems of the Maintenance Officer

"The deep interest which I have always had in the maintenance-of-way department stems from an apprecition of the many handicaps under which your work is performed," said Mr. Aydelott in his opening address before the opening address before the opening joint session on Monday. Track and bridge work, he went on, must, except in a few instances, be carried on under traffic and many of your problems are the result of this situation. These problems, he pointed out, because of shortening of train schedules, increased traffic on many single track lines and higher standards of maintenance will probably grow rather than diminish.

Mr. Aydelott then discussed certain measures which might provide relief in this situation, including stabilization of roadbed, greater use of off-track equipment, increased mechanization, higher standards for materials, improved methods of transporting men to and from work, and high standards of supervision.

The expanded research facilities of the A.A.R. which is investigating the behavior of basic materials used in track and bridges, were then discussed by Mr. Aydelott. "Most of you," he said, "in your respective territories have installations of a test nature, and too much stress cannot be laid upon these installations, since they may prove to be of extreme value not only to your company but to the entire railroad industry."

In closing Mr. Aydelott mentioned that the sharp upturn in business has created a serious car shortage. "To overcome the shortage," he said, "a great many things will have to be done to secure greater car utilization, and among these is the prompt release of cars in which you receive your materials."

Supervision and the World Crisis

Mr. Newell's address on The Role of Supervision in the Present World Crisis, was divided into two parts. In the first portion he emphasized the importance of proper supervision, and of improving the quality of supervision to obtain better performance from the maintenance-of-way forces. Good supervision is necessary, he said, to assure that maintenance allotments are spent properly. From the supervisory officers in this department come the ideas and suggestions for assuring forward progress of maintenance-of-way practices. Such officers, he said, because of the location of many of them in outlying communities, are in an ideal position to develop local respect and appreciation for the railroads, and they are also the roads' first line of supervisory defense in wrecks, floods and other emergencies.

Speaking of the eagerness of management to develop better supervisors Mr. Newell recommended that his listeners read Elbert Hubbard's "Message to Garcia," and then listed six questions which he said "are basic and worthy of your attention." These are (1) Are you happy? (2) Can you distinguish between essentials and non-essentials? (3) Are you predictable under pressure? (4) Do you have personal integrity? (5) Do you accept your responsibilities? and (6) Are you loyal?

In the second part of his address Mr. Newell developed the thought that the things he had been discussing constitute a prerequisite for the role that supervision must take in the present world crisis. He then discussed some of the detailed problems that would be encountered by maintenance-of-way departments in the event of another world conflict, such as extremely heavy traffic, shortages of materials, and lack of manpower. However, he told his listeners that "you should know all the answers—both from your review of your experience, and from careful analysis of mistakes and errors in past experience."

Mr. Newell then mentioned "two new and very serious problems" that may face the railroads if war should develop, adding that these two problems will place a "tremendous responsibility" on the shoulders of supervision. They are, he said, (1) Possible sabotage, and (2) the possibility of ex-

plosive bomb and atomic bomb attacks, in view of the great developments in aircraft in the past five years.

Personnel Relations and Efficiency

"No program for all-out efficiency, regardless of how many machines it may provide, can be thoroughly successful unless it takes account of the men who are still the basic component in maintenance-of-way work," said Mr. Horning in his address before the joint session on Tuesday. "This," he went on, "is where personnel relations enter the picture. The pursuit of a personnel-relations program involves the forming and carrying out of policies conducive to good feeling and, therefore, to good work."

First, Mr. Horning declared, we are interested in seeing that the men working for us do a good job, and our prime task boils down to one of helping men do good work. To do this, he said, one must consider the things that a human being craves simply because he is a human being—such things as the desire for personal dignity, a need to enjoy a sense of accomplishment in his work, and the need of feeling that what he does is appreciated. Whether or not a job fills these three needs, he went on, depends largely on the attitude of the company, as expressed by the various levels of management and supervision, towards its employees.

Mr. Horning then explained how the satisfaction of workers with their jobs can be brought about. Supervisors and officers, he said, should respect a worker as an individual; believe in their men; create respect by competence and leadership; explain frankly the reasons for certain policies; let employees know what's going on; offer commendation for a job well done; base all promotions strictly on merit; broaden the worker's field of activity if he is doing well at the job assigned him; delegate authority and use men to capacity; and listen to suggestions, questions and "gripes."

In conclusion Mr. Horning discussed how management is backing up the

TREASURER'S REPORT

SEPTEMBER 1, 1949 TO AUGUST 31, 1950

Cash Balance, September 1, 1949		$1,540.53
RECEIPTS:		
Dues	$2,108.00	
Advertising	1,867.60	
Miscellaneous	57.30	4,032.90
Total		$5,573.43
DISBURSEMENTS:		
Salaries	$ 684.67	
Social Security and Withholding Taxes	106.67	
Stationery and Printing (Including 1949 Proceedings)	2,113.46	
Postage	164.25	
Rent, Phone, Electricity	285.47	
Premium on bonds for Secretary and Treasurer	20.00	
Convention Expense (1949)	238.96	
Miscellaneous	175.86	3,789.34
Cash on hand, August 31, 1950		$1,784.09
ACCOUNTS RECEIVABLE:		
Due from Advertisers in 1949 Proceedings		1,880.00
Total as of August 31, 1950		$3,664.09

L. C. WINKELHAUS,
Treasurer

maintenance man's efforts toward greater efficiency through its endeavor to iron out some of the peaks and troughs of maintenance-of-way employment so that steady work can be offered to more men, through its encouragement of modernized techniques, and through its increasing interest in training men.

The Supervisor's Role in Accident Prevention

In discussing, before the joint session on Tuesday afternoon, the supervisor's responsibility in the prevention of accidents, Mr. Harper said that before supervisors can expect to put over a safety program they must first of all be sold on safety themselves.

Mr. Harper then discussed the role of supervisors as teachers, saying that no one can have the same prestige with workmen, or the same power to educate men in safety, as the man to whom the workers report. Therefore, the competent supervisor must have the confidence of his men and be so interested in them that he will have a personal desire to train them into the best possible workmen. "It takes a man with real executive ability to develop a safe, efficient and successful workman out of a potential failure," he declared.

Too many supervisors, said Mr. Harper, merely tell their men that rules must be observed and that certain practices must be performed rather than explain why it is to the workman's benefit to operate in a safe way. "Selling safety," he went on, "is just like selling anything else. You will have to persuade the prospective customer that you have something that

SECRETARY'S REPORT

of

MEMBERSHIP AS OF SEPTEMBER 1, 1950

Active Membership as of September 1, 1949		468	
New Active Members since September 1, 1949		83	551
Reported deceased since September 1, 1949	4		
Resigned since September 1, 1949	2		
Dropped account non-payment of dues	46		
Transferred to Life Membership	7		59
Total Active Members — September 1, 1950			492
Associate Members — September 1, 1949		115	
New Associate Members since September 1, 1949		14	129
Reported deceased since September 1, 1949	2		
Dropped account non-payment of dues	2		4
Total Associate Members — September 1, 1950			125
Life Members — September 1, 1949		90	
Elected to Life Membership since September 1, 1949		7	97
Reported deceased since September 1, 1949	2		
Dropped a/c mail returned	2		4
Total Life Members — September 1, 1950			93
Honorary Members — September 1, 1949		3	3
TOTAL MEMBERSHIP — SEPTEMBER 1, 1950			713
TOTAL MEMBERSHIP — SEPTEMBER 1, 1949			676
GAIN FOR YEAR			37

will benefit him, and that he will be better off after he has accepted what you have to offer."

In the remainder of his talk Mr. Harper disposed of the various excuses offered by some supervisors in defense of their poor accident records. To the man who complains that he can't watch his men continually, Mr. Harper said, "no one expects you to. The main thing is—what do you about it when you see a safety violation." In commenting on the supervisor who says he doesn't have time to teach safety, Mr. Harper said "you don't have time to do anything else but teach safety. If we fail in safe operation, we have failed in everything else." For the benefit of the supervisor who complains that he gets tired of telling the same thing every day, Mr. Harper drew an analogy between the advertising business and safety work. "Advertising people," he said, "know that the more times a product is talked about the better it will sell."

Types of Treated Lumber and Uses in Building Maintenance and Construction

Report of Committee

R. W. Cassidy (chairman), supr. b.&b., C.&O., Peru, Ind.; L. R. Morgan (vice-chairman), fire prev. engr., N.Y.C., Detroit, Mich.; E. L Collette (vice-chairman), div. engr., St.L.-S.F., Ft. Smith, Ark.; S. K. Autrey, b.&b. and w.s. inspr., Burl-R.I., Teague, Tex.; R. H. Bescher, mgr. tech. dept., Koppers Co., Inc., Pittsburgh, Pa.; H. A. Boehling, Jr., asst. cost engr., C.&O., Richmond, Va.; W. H. Bunge, asst. engr., M.P., Houston, Tex.; W. W. Caines, supv. b.&b., C.&O., Huntington, W. Va.; R. R. Clegg, dist. sls. mgr., Amer. Lbr. & Trtg. Co., Chicago; F. D. Day, asst. mast. carp., P.R.R., Pittsburgh, Pa.; L. T. Ericson, ch. engr., Hennison Wright Corp., Toledo, Ohio; D. B. Mabry, mgr. lbr. sls., T. J. Moss Tie Co., St. Louis, Mo.; F. J. Stewart, ch. engr., P.E. Belt Line, Port Everglades, Fla.; S. R. Thurman, b.&b. supv., M.P., Nevada, Mo.

The railroads today are faced with the problem of selecting the most effective preservative for the lumber and timber used in building construction and maintenance. The native species of timber which are more resistant to termites and decay are too expensive and difficult to secure. As an example, farmers in the east and middle west maintained catalpa groves on their farms to provide a constant supply of 30-year fence posts. They now find it more economical to use treated posts and cultivate their land for other purposes. Some species of timber are more resistant to decay and termite attack than others, but the proper handling and the selection of the most effective treatment for the particular uses will add to the serviceable life of all species. Railroads would spend many more millions of dollars annually if treated lumber was not available.

Southern pine and Douglas fir are the most widely known species of building lumber used by railroads today. Black gum is used for decking where heavy traffic is expected. These species of lumber are highly susceptible to decay and termite attack. They all react favorably to all types of treatment. However, it is necessary to incise fir timbers to obtain adequate penetration of the treatment.

Careful handling and storage of treated timber is very important. Creosoted timber should be stacked and covered with dirt if this type of material is not to be used promptly. It is also very important to keep the area around the stacks free from weeds and grass. Every precaution should be observed to avoid any damage which would result in the evposure of the portion not reached by the treatment. Timbers treated with either preservative salts or fire-retardant chemicals should be stored under shelter to protect the lumber from the elements. This material may warp readily and some of the chemicals will tend to leach out under certain conditions of exposure to the weather. Service records indicate that one salt preservative is fibre-fixed and the problem of leaching is not serious in this type of treatment.

Types of Treatment

Many types of treatment are available today, each having characteristics when combined in building construction and maintenance to provide long life for the structure. Creosote and creosote solutions are most effective preservatives when used in members in contact with the ground. Some rail-

roads recommend that the entire substructure of a building, including the floor joints, be creosoted.

Water and oil-borne salt solutions are most generally used in the framing and exposed wood portions of the building. These types of treatment are clean, provide protection from decay and termite attack, and do not affect the paint ability.

Many railroads have found it desirable to use timbers treated with fire-retardant chemicals in the construction of buildings where a fire would result in heavy loss of equipment or freight. This type of treatment is designed to retard the speed of fire and thus permit more effective fire fighting.

The costs of various types of treatment will generally run from 30 per cent to 50 per cent over the cost of the untreated product. This additional cost has proven a good investment in the reduction of labor and material.

Railroads contacted to determine the extent to which treated lumber is used reported that its use is recommended in all building construction and maintenance. The usual preference in construction of roadway buildings is as follows:

Posts, sills and floor joists to be creosoted.

Framing, sheathing, siding, trim and millwork to be treated with water-borne salt chemicals, or other toxic chemicals which can be painted.

In shops and enginehouses containing coal-burning locomotives, salt treatment of the lumber is recommended in the structural portion of the building.

It is emphasized that the roof trusses, columns and other large members should be preframed before treatment to insure the full advantage of the treated lumber. The importance of treating other exposed lumber in these types of buildings is also considered good practice. The use of creosoted wood blocking with the end grain for the wearing surface has given satisfactory service on many railroads. Also the extensive use of creosoted black gum in platforms, walkaways andfloors has proven economical and satisfactory.

Windows and window frames seem to be the first portion of a building to show signs of decay. The treatment of these items is thought to be of particular importance.

One railroad brought out the fact of using timber treated with water-borne salts having contact with untreated timbers under excessive moisture conditions would result in rapid leaching of the treatment.

The necessity of maintaining buildings with treated lumber was forcefully brought out during the recent war—scarcity of the product and priorities made railway maintenance and stores people find means to extend the life of timber to the greatest. Furthermore it was discovered that, while treated lumber may eventually decay, it can be left in service longer as the sound portion will retain sufficient strength for a much longer period after decay starts than untreated lumber after decay sets in. Knowing this, the bridge and building inspectors will not have the tendency to be extravagant in their recommendations for repairs.

Careful inspection of all buildings

Strength in Bending Corrected to 12 Per Cent Moisture Content

Specimen No.		Stress at Proportional Limit	Modulus of Rupture	Modulus of Elasticity
			(lb. per sq. in.)	
Log 1, piece 1	Salt Treated	5,940	8,510	1,664,000
	Untreated	7,600	9,770	1,817,000
Log 1, piece 2	Salt Treated	6,650	8,700	1,540,000
	Untreated	6,740	10,100	1,652,000
Log 2, piece 1	Salt Treated	7,820	10,090	2,262,000
	Untreated	7,400	8,790	1,923,000
Log 3, piece 1	Salt Treated	7,950	11,460	2,336,000
	Untreated	9,960	11,980	2,585,000
Log 5, piece 1	Salt Treated	8,200	8,950	1,952,000
	Untreated	6,790	10,560	1,760,000
Average	Salt Treated	7,310	9,542	1,951,000
	Untreated	7,698	10,240	1,947,000

programmed for repairs is important to determine what type of treatment of the lumber to be used will provide the most satisfactory service.

The effects of treatment on the strength of lumber have been given careful consideration by the treating companies and industries. The results of the following tests indicate that the strength of pieces were only slightly affected.

For the strength tests, the specimens were taken from four coast-type Douglas fir logs. From each log several pieces 4 in. by 8 in. in cross section and 24 ft. long were sawed, after which they were cut into two halves, each 12 ft. long, one to be treated and the other to remain untreated as an end-matched control. A total of five pieces was selected for salt tratment without incising by the standard vacuum-pressure process for green Douglas fir lumber. The pieces were kiln dried after treatment and tested in bending and compression along with the untreated controls. The results obtained are shown in the accompanying table.

Another factor which should not be overlooked is the salvage value of treated lumber used in building construction and maintenance. In many instances railway buildings become obsolete from the standpoint of occupancy, and when retired and razed, the salvage value is much greater when treated lumber was used in the structure.

As a summary, it is thought the railroads as principal users of treated lumber produced today will continue to do so in order to offset the high cost of labor and material in building construction and maintenance.

Discussion

W. A. Huckstep (M. P.) began the discussion by stating that, in taking down a building built of treated lumber at a steam locomotive shop, much of the lumber was salvageable. In razing a building built of salt-treated lumber at Little Rock, Ark., H. Wrights (M. P.) stated that about 75 to 80 per cent was salvaged. This compares with a salvage of 50 per cent of untreated white pine from a similar razing job, according to J. Anderson (M. P.). White pine lumber as good as that used in this structure is not available today, he added.

E. H. Barnhart (B. & O.) questioned the amount of salvage that is being obtained on such jobs, saying that cutting off the ends of the pieces of lumber will materially reduce the percentage. Chairman Cassidy said that when treated tongue-and-groove sheathing was removed from a roundhouse at Peru, Ind., none of the material was salvaged because of nail damage. President Martens stated that he was on a salvage job that required 2½ years to complete, and that almost all of the recovered material had to have the ends sawed off.

Mr. Huckstep cited an instance where all of the lumber recovered from a building was sent to a central plant where the nails were withdrawn and the material sawed, resulting in the salvage of usable lumber worth about $300 per carload after salvage costs had been deducted G. S. Crites (B. & O., retired) stated that lumber is generally reclaimed because of its scarcity rather than its value. If lumber is hard to obtain, he said, it is proper to salvage all the lumber possible, otherwise it is uneconomical.

In response to an inquiry by President Martens about the effect of wood treatments on hardware, S. R. Thurman (M.P.) a member of the reporting committee, said that in water-borne salt-treated lumber, nails rust about the same but not more than in lumber of other treatments. If zinc-treated nails are used, there is no perceptible rusting. Also, there is no apparent rusting of such nails with the creosote treatment.

Mr. Barnhart asked about the effect of salt-brine drippings on hardware in creosoted and in untreated lumber, to which President Martens replied by saying that he knew the exposed parts of the hardware were affected but he could not advise on the unexposed parts. R. D. Hellweg (G. M. & O.) stated that he protects the exposed parts of hardware from brine drippings by coating them with roofing pitch. L. H. White (I.C.) said that he uses a protective coating of petroleum products or plastic cement in many instances, which has proved effective when applied cold to the tops of bolts. He warned, however, that these protective coatings were ineffective when applied after the rust has become well established, and likened the coating to the application of similar coatings on the underparts of new automobiles. A member of the reporting committee, R. R. Clegg (Amer. Lumber & Treating Co.) stated that if the members were further interested in the corrosion of hardware in treated woods, an extensive report on this subject had been prepared by one of the committees of the American Wood Preservers' Association.

Mechanization and Specialization of Forces

Report of Committee

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Mechanization and specialization of forces is a subject that will start enthusiastic discussion wherever railroad men gather.

We have witnessed a tremendous increase in mechanization over the last two decades and an increasing tendency toward specialization. Mechanization is well established and we do not intend to devote this report to its justification. We are now more concerned with refinements, trends and problems. We are not so sure about complete specialization and many of us are concerned with its problems.

We have a tendency to become so engrossed in our individual problems and so absorbed in our routine work that we have too few opportunities to pause and consider the problems of our fellow workers. Conventions of men having common problems and interests are a constructive medium. We come here to find out what the other fellow is doing and receive ideas that may be helpful.

A rather comprehensive questionnaire was prepared by this committee and submitted to 30 Class I railroads. Twenty-five replies were received and we feel that this provides a representative cross section of opinion regarding our subject matter. This report has incorporated these expressed opinions and is being given in the hope that you will receive some help. We hope that it may induce some healthy discussion.

Our subjects are broad and it is difficult to properly cover them in one report. We have attempted to separate the two general subjects and shall first deal with mechanization of forces.

Work that bridge crews are called upon to perform is too diversified to permit us to cover all operations completely. However, we may enumerate some of them and compare these operations when done by hand and when done by power methods.

Most railroads have many miles of timber trestles that they must maintain. Materials can be handled into and out of these structures by a small derrick mounted on a track push car, operated by hand or powered winch. Some locations and conditions permit the use of off-track cranes for this purpose. Guards, ties, stringers, caps, and braces can all be cut and drilled with power tools and the drifts and bolts applied with power hammers and wrenches. Present practice utilizes preframed and bored creosoted timbers. Field operations are thereby minimized. Power tools will conservatively save 25 per cent of the number of man-hours required for these operations when they must be performed in the field. The saving on some operations, such as drilling holes for chord bolts, will greatly exceed this figure.

We hardly think of performing steel work without the aid of power tools, but many maintenance operations are often performed by hand. Cleaning of steel, preparatory to painting, can be done with sand blasting, flame softening, chipping and scaling hammers and powered wire brushes. Some spots are not accessible and some hand cleaning is essential but the largest part can be handled with power. Paint can be applied by spraying in a fraction of the time required by hand brushing, although many will question the quality of the finished work. Rivets can be heated by oil, gas, or electricity in portable heaters that better control the temperatures and are safer to use. Rivets are removed and redriven by power, producing a better job. Holes are drilled and reamed with power. Welding and cutting outfits are most helpful. Power grinders are useful. In fact so many operations are now performed with power tools that our costs would be prohibitive if we had to revert entirely to hand methods.

Mechanizing Concrete Work

Power tools and equipment are most essential for concrete work, either new construction or maintenance. Considerable work is done within short hauling distances of ready-mixed concrete plants and many companies draw heav-

ily upon this relatively new product. A 3-S mixer, on pneumatic wheels, can be set up and used for small jobs, and 11-S mixers are easily enough handled to be used on larger jobs. Loading and unloading conveyors are available for handling aggregates and even the mixed concrete. Concrete can be pumped directly to the point of deposit. Portable pumps make water available for mixing, curing and cleaning. Paving breakers, chippers, drills, brushes and grinders rather quickly remove masonry for repairs. Power saws and drills simplify the installation of forms. Pressure grouting machines allow reintegration of masonry which otherwise might have to be completely replaced. Pressure application of cement mortar will restore entire surfaces.

A type of construction involving precast concrete slabs on concrete piles and caps is being used successfully by several roads to replace timber structures. These provide longer life and reduce maintenance expenses. Some of the above-mentioned operations could hardly be performed by hand. We feel conservative in saying that savings of at least 25 per cent will be realized from use of power when the choice is available, on any but the smallest jobs.

Building crews find portable power saws and drills indispensable. One man with a power saw can frame lumber as fast as six men can install it. Prefabricating door and window frames, in many cases including installation of sash, will greatly expedite the work. Platform work can utilize saws, drills and impact hammers and increase output by close to 50 per cent. Heavy framing can be expedited with chain saws, drills and power wrenches in the assembly. Power brushes and chipping hammers will clean masonry and rake joints. Mortar can be mixed in small portable mixers. Preservative treatments can be applied with pressure sprays. Roof coatings may be pumped to the roof and applied by spraying, effecting considerable economy. We do feel that utilization of power tools by building crews will result in savings of approximately 25 per cent in labor operations.

Old paint can be removed rapidly with power-driven wire brushes and flame cleaning if proper precautions are taken. A portable paint mixer will do a better job in considerably less time than stirring by hand. Paint can be applied with spray guns and gun extension pieces can be used to minimize the moving of scaffold staging.

Tools for Water Service Men

Water service crews vary considerably in the scope of their duties. The introduction of Diesel power has greatly altered the problem of maintaining pumps and other facilities. Water service crews on many roads are now primarily plumbers and sheet-metal workers. Portable pumps, drills, grinders, electric soldering irons and tin shears, and welding and cutting outfits are becoming standard equipment. A power-trenching machine will greatly expedite underground piping. Pipe cutting and threading machines can be taken to the field and powered by electric generators. Powered equipment will reduce labor costs about 50 per cent.

Many railroads have work shops, usually located at the division headquarters. The shops are equipped with wood-working tools and machines and metal-working equipment. An adjustable bench saw, radial saw, band saw, jig saw, jointer, planer, shaper and drill press will allow two men to perform work in the shop that will save at least 50 per cent in labor. Window sash and woodwork in many old buildings can only be replaced by custom-made duplicates. Prefabrication and match marking of forms for concrete work can be economically performed in a central shop and shipped to the job site for assembly. Sheet metal breaks, crimpers, corrugators, power shears, and electric soldering irons allow gutters, down-spouts, fittings, heating pipes and conduits and many other products to be made economically. This same shop may be expanded to provide sharpening, and light overhaul repairs for many of the power tools and light equipment in use on the division.

A logical development is to provide proper storage and service facilities for those items of division equipment and tools that can best be utilized by pooling. Emergency repair parts should be available in case of breakdown. Automobile trucks can be serviced at the division shop, especially if they are tied up for the week end. Many roads have these facilities serving as a headquarters shop for the division traveling mechanic.

Use of Automobile Trucks

We have so far made no mention of possibly the most important trend in bridge and building crew work. Traveling bridge crews and paint crews usually move from one site to another

with camp cars. However, most roads are now adding a high degree of mobility to these crews by assigning automobile trucks for their use. These trucks are being used for transporting men, materials, tools and equipment from the camp cars to the job site. A considerable amount of time can be saved this way with the additional safety of travel.

You have many times seen an entire crew sitting in the hole waiting for lineups or clearances so that the motor car may be safely operated. This time waster and hazard is removed with trucks, although we now introduce the hazard of highway traffic. So far the safety records have proved most satisfactory. Terminal crews, water service crews, and traveling mechanics are now usually assigned trucks. The mobility of these crews has increased their available work time to a great extent. Trucks are being used successfully in trestle-filling jobs and in many cases it is possible completely to eliminate work-train expenses.

Off-track equipment is receiving increased consideration for many operations. Definite savings are possible by increased mobility, speed of movement, reducing delay to clear trains, and minimizing the use of work trains. Equipment adaptable to more than one type of operation is finding increasing favor.

A high degree of mechanization is invaluable in time of emergencies, such as at washouts, burnouts, or derailments. Continuous and safe movement of traffic is essential, and interruptions are disastrous. Anticipation of emergencies and preparedness may exert considerable influence upon the number and type of tools and equipment furnished to work forces.

Good Judgment Needed

Judgment must be used when power tools and equipment are selected and purchased. You are all familiar with the claims of what a particular tool or piece of equipment will do. Very frankly, many claims do not work out. Field conditions are not always ideal or equal to conditions on a demonstrator floor. In fact it is extremely difficult to obtain time studies for work operations and use these studies with any degree of confidence. The conditions under which you may be working will vary so much that you will either disappoint yourself or your management if you make claims that you have read some place or have been told should apply.

We are all guilty in this respect. We have observed an operation by others or listened to some individual and become so enthusiastic over possible savings that we have been led into many mistakes in the purchase of power tools and equipment. None of this has been done wilfully and our enthusiasm has been sincere. The savings are possible of attainment but we do not always obtain them. The men using the power tools and equipment sometimes have to be "sold" on the idea.

An average bridge crew of one foreman and nine men will cost about fifteen dollars per hour or twenty-five cents per minute. The utilization of power equipment to save this bridge crew's time will add up quickly, and savings accumulate rapidly. Unfortunately the reverse is also true.

Delays Are Costly

If a bridge crew is delayed 10 minutes by digging into the tool car for the power equipment and again 10 minutes by putting the equipment away at night, you have lost $5.00. It will take two men about ten minutes to set up the generator on the job, stretch out the cables and connect up the tools. There goes another 35 cents and you charge this again at night. It will cost you about ten cents to start or stop the equipment if it is in good condition and the ordinary attention during the work day will cost at least 50 cents. A balky generator that delays a bridge crew for 10 minutes costs $2.50. Then, too, you must figure that a generator costs about 55 cents per hour to operate, including allowances for overhead. This makes no allowance for the costs of your power tools which should also be added.

Air equipment costs more to set up because ordinarily you have a compressor that must be moved into position for work. You can expect an expense of at least 10 to 25 dollars to get your equipment in place, lines strung out and ready to work. You have this expense repeated when you are through with the job. It is rather common practice to cover the compressor, lock it up, and leave it at the job site, and when this is done set-up expenses are not daily occurrences as is usually the case when electric equipment is used.

We wish to emphasize these expenses. They may be overlooked when you compute savings to be made in using power equipment. If you will keep them in mind and impress them

upon your foremen you will eliminate the criticism of using power tools when hand operations would actually prove to be cheaper. Power equipment is not the final answer to maximum economy. Its use must be tempered by judgment and not wasted on minor work. If this is not done you may experience loss of your equipment to crews who will utilize its possibilities more efficiently.

Care of Equipment

One of the most serious problems confronting us is the proper care of power equipment. Many foremen and workmen dislike power tools because of the maintenance attention required, and, to say the least, it is difficult to keep the tools in proper condition. One chief engineer states that a man will sharpen his saw or his foot adze, but will neglect properly to lubricate a power tool. Hand tools may often be the property of the individual but power tools are the property of a large corporation. It is difficult to instill the same pride and care that ownership provides.

Power equipment is ordinarily rather a complex mechanism and is subject to breakdown or failure if not properly cared for. Sufficient power can be built into a tool to perform nearly any operation but the power equipment that we use has definite limitations. If men overload and abuse a machine they cause excessive wear and commonly burn it out or completely destroy it. An improperly lubricated piece of equipment will wear rapidly and commonly fail. Equipment that cannot be used on the job cannot earn a penny and overhead expenses go right on eating up savings that could be realized.

Our study indicates that approximately 75 per cent of bridge department crews are equipped with power tools. It would require an extended study to fix the dollar value of this equipment but the total would be amazingly large. Surely this reflects the confidence our managements have placed in the value of power equipment and also indicates the responsibility that we have.

We find about 75 per cent of the companies have large centrally-located shops in which heavy repairs and overhauls are made. About 50 per cent of the lighter repairs and overhauls are made in division shops. About 70 per cent of the companies have traveling mechanics who service and make light repairs in the field. Two-thirds of the companies report that they have an organized preventive maintenance program but almost the same number report that service is given only after breakdowns occur. Seventy per cent of the companies do not require monthly condition reports on equipment. It becomes more apparent why the traveling mechanics are so broadly utilized and, the preventive maintenance programs may be subject to improvement.

Foremen and even supervisors are reluctant to ship a piece of equipment when it is necessary to ship it a long distance and lose its service for a long period of time. This probably accounts for so much service being done only after breakdown of the equipment. The solution of this problem is being given very serious study by those men responsible for keeping equipment on the job and working. Off season overhauling will work for much of the equipment but does not provide for the year-round equipment. Many roads pool equipment and thereby can assemble it periodically for overhaul. Pooling of power tools may work successfully but the lack of personal responsibility for the care of an assigned tool enters in this case.

Benefits From Equipment

A sample of opinions showed almost unanimous agreement that increased use of power tools and equipment would: (1) Increase man-hour output, (2) decrease man-hour costs, (3) improve quality of the work, and (4) result in overall economy of the work. We found that, in the opinion of the men reporting, they estimated an average saving of 31 per cent from these items. You may take this for what it may be worth, at least it is something for you to think about and aim at in your own work.

The opinion has been expressed that railroad work in general is far behind the practice of contractors in the utilization of available equipment. Our economies are not dependent upon the development of new machines but more on how we use what we have. This is borne out by the reporting railroads. We find that they consider greater savings will be obtained by the following, listed in order of importance: (1) More extensive use of power tools, (2) closer planning and supervision by officials, and (3) better training of workmen. Only one railroad considered the design of new tools and equipment as being most essential.

We do not want this to be inter-

preted by the equipment industry that we are complacently satisfied with their present products. Railroad work is rough work and all too often present equipment does not stand up under the conditions we subject it to. Ruggedness is essential but the resulting weight is a handicap. Alloy metals used to reduce weight often break too easily. It is almost impossible to repair most plastic parts. Many other objections could be listed but suffice to say "we are always looking for lighter and better mouse traps."

A Supervisory Problem

Getting back to savings in cost of work, the finger of responsibility points directly at the gentlemen assembled in this convention and others in like position. Each item considered most important is distinctly a supervisory problem. It is not sufficient to ask for and get more power tools and equipment, turn them over to a foreman, walk off and leave him, and expect miracles to happen.

We are now confronted with a 40-hr. week and higher hourly wage rates but unfortunately we did not have a bargaining agent that obtained less work for us to do. A little over a year ago we performed 48 hr. of work to maintain our roads according to our several standards. We do not admit that we were over maintained, or that our standards were too high. So today we have the real problem of trying to increase our man-hour output by 20 per cent in order to equal the old volume of work. We venture the guess that as of today we have not reached that goal.

It would be most helpful if you gentlemen assembled here to discuss our many problems could return to your jobs with a pat formula that would decrease your costs or increase the efficiency of your men by the minimum desirable amount of 20 per cent. You will not find such an easy answer available to you.

Closer supervision and more careful planning of work is absolutely necessary if you want to accomplish any results. This will mean that more of your time must be spent out on the job in close association with your foremen. You cannot interfere with his work. You cannot take over his work. You can help him plan his work to minimize waste time and delay. You can assist the personal welfare of your men and strive for better morale. You can improve your flow of materials and equipment to the work. You can often reduce the cost of interfering with railroad traffic by proper assignment of power equipment to the job. Cooperative relations with your operating people will pay large dividends. You can stay alert to new developments, new ideas, and suggestions. All of these and many more are your tools and their successful employment is limited only by your own ability. Our reporting roads estimate that this field can effect a 20 per cent increase in efficiency of the work.

Even though closer and more alert supervision is indicated as a need, 75 per cent of the roads do not contemplate increasing supervisory forces. More training for supervisors is thought necessary, but only a few roads report having a definite training program.

Getting Better Workmen

Better training of workmen is considered essential. Many of us have bridge crews with some old hands still left to guide the way. They are artists in their field but we are rapidly losing them, and it is my personal observation that many of the young men attracted to our work are not of the same fibre. It is also true that many of the old hands are primarily hand-tooled artists and in many cases do not take readily to new ideas. Most of the young men are receptive to suggestions and appreciate the use of power tools. They like to put the load on a tool instead of themselves and they will usually take care of that tool if they know that by doing so their work will be made easier. Many young men were in the war and came out with some training in the use of equipment. We find the commonly expressed opinion that power tools are necessary to attract new workmen and hold them is in error, except in the opinion of very few reporting roads.

Training Workmen

Staying within the limits of seniority requirements, you can see that your foremen give these young men the opportunity to use their knowledge and their abilities. You can also see that these young men work in such a way that they can be guided by the old hands and hope that they thus acquire some of their know how. Proper handling and training of workmen is probably your most difficult problem and there is no ready solution. Our reporting roads estimate that better training of workmen can effect a sav-

ing of 20 per cent in doing the work. This is worth pushing for all its full benefits.

The greatest saving in cost of work is to be achieved by more extensive use of power tools and equipment. Our reporting roads estimate that a 25-per cent saving can be realized in this manner. This figure may be high but the increase of man-hour output is unquestionable, if power is judiciously applied. Machines can work for long periods and experience no physical weakening. Power is fast and does not experience fatigue. The possibilities of power is limited most by the men who use it. In the final analysis, however, any possible economies that may be realized from the use of power hinge upon the judgment exercised by the supervisor and his foremen, and the abilities of the men.

More Information Needed

This report has generalized the savings that may be effected by power tools and equipment. Some companies have made time studies of certain operations in order to be better informed as to the success of their programs. Unfortunately, the experiences of one road will serve primarily as a guide to another and not as an accurate measure. We strongly recommend that information be assembled that can be accepted and that this information be correlated. So far, most of us have been too busy using what we have available to stop and analyze what it is doing for us and what improvements can be made. An authoritative study would make an interesting and useful report at some future date.

In our general search for economies we sooner or later arrive at the possibility of using specialized forces. In our report we will refer to general composite crews as those performing all phases of work and to specialized crews as those performing work in specialized fields. We have sampled opinion on this and find some interesting results.

We find that 63 per cent of concrete work is performed by general crews on line of road and 90 per cent when within terminals. Eighty-five per cent of steel work is performed by specialized crews. Seventy-five per cent of timber bridge work is performed by general crews. General crews perform 62 per cent of building work. Division work shops, painting, and water service is performed by specialized crews to a great extent. Opinion is divided as to preferences, with 40 per cent of the reporting roads favoring specialized work crews and 60 per cent favoring general work crews.

The principal reasons expressed for favoring specialized crews were that they were more efficient, and that experience in a special type of work improves the quality of work and lowers costs.

The principal reason expressed for favoring general crews was that specialization would increase jurisdictional disputes among the crafts. Closely following was the opinion that general crews are more versatile and flexible and that transportation of the men from one job to another causes less lost work time. We received as many opinions that general work crews were more efficient and economical as were obtained favoring specialized crews. Several roads reported that they did not have sufficient work to allow for specialization of crews.

Effect of Labor Agreements

We gather from our survey that labor agreements have a strong influence on any attempt at specialization of work forces. Specialized workmen must be selected on the basis of seniority rights and cannot be hired from outside the organization. Some exceptions are possible if no men are furloughed or available on the rosters but very few men can be obtained in this manner. Many roads have no provision in their labor agreements to allow formation of system work crews.

Several roads are considering the possibility of establishing fixed headquarters for crews and having them travel by truck. Tool and material cars would be set out near the job site. Track motor cars and push cars would be retained but principal travel would be by truck. Complete camp car outfits are still used almost entirely for work on line of road but they are expensive to maintain and are becoming more so as conveniences are added. Agreements now require that camp cars be provided for many types of railroad work crews.

Specialization

Mechanization inevitably results in some specialization of individual workmen and of entire crews. The degree of specialization will require careful study by supervisory personnel in order to obtain maximum results. Power tools and equipment represent too large an investment to entrust them to anyone who does not appreciate them

or will not render proper care. We now see too much damage and destruction result from carelessness and feel reasonably confident that we are not obtaining the maximum efficiency from tools and equipment that we have.

We conclude that substantial savings and increased output can be achieved by: (1) Increased and judicious use of power tools and equipment that we now have or are now available; (2) that more efforts will be required from supervisory personnel in planning and coordinating work, equipment, materials, and men; (3) a program of training for supervisory personnel so that they, in turn, may institute training methods for workmen. In view of the wide difference of opinion regarding the merits of specialization we suggest that each case be weighed carefully before taking steps that may complicate future cases.

Discussion

Referring to that part of the report that described the transportation of men in trucks, J. A. Jorlett (Penna.) related that about two years ago, when a fire broke out near the tailgate of a truck carrying employees, several men were singed and burned because there was no way to signal the driver to stop. His trucks are now all equipped with an independent signal system for contacting the driver from the rear of the truck body.

G. S. Crites (B. & O., retired) observed that transporting men by motor car frequently results in overtime, whereas trucks eliminate the overtime and in addition can take the men directly to their homes. On the other hand, he warned, highway hazards and accidents are becoming more prevalent.

External Protection from Corrosion for Pipe Lines

Report of Committee

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The amount of damage done each year to water, gas and oil lines by corrosion has been a matter of much concern for quite some time. Accurate estimates of the loss resulting from corrosion and the cost to the railroads each year are not possible, but there is no question that this sum is very large. Costly replacements of pipe, both overhead and underground, are mostly due to the effects of corrosion. Losses of the fluid through leaks caused by corrosion may amount to another sizeable sum. Increased maintenance costs and greater out-of-service time are other effects of damage caused by corrosion. This is especially true of pipe lines under several feet of cover or in inaccessible places. While not all of these losses can be prevented, they can be reduced considerably by one or more of the main techniques used for controlling the rate of corrosion, namely, protective coatings, alloying, cathodic protection or change of environment.

This report is intended to serve as a guide only for the external protection of iron and steel pipe, since these metals are most generally used for piping systems and are subject to the major portion of the corrosion that takes place.

The conditions which bring about the deterioration of the iron and steel pipes are entirely different underground than when exposed to the atmosphere. For this reason, the prevention of underground corrosion and atmospheric corrosion will be discussed separately.

Corrosion of pipes is simply an electrochemical reaction by nature in an attempt to revert the iron back to its original form as an ore. By fully understanding the basic principles of corrosion and by making use of the most effective methods of reducing the rate of corrosion, large sums of money can be saved annually.

Atmospheric Corrosion

Corrosion of pipes exposed to the atmosphere is influenced by the length

of time the pipes remain wet, by the extent and kind of atmospheric pollution, by the presence of condensed moisture in the rust film and by the composition of the metal. Protective coatsings have been developed to the extent that they may be the most economical method of controlling corrosion.

Paints are effective against atmospheric corrosion in that they isolate the metal from moisture and oxygen in the corroding environment. Paints generally used on piping that is subjected to moist atmosphere usually are of the asphaltic or bituminous type—applied over a suitable primer. Red lead, when used as a primer, not only protects the metal by shielding it from the environment but also because of its inhibitive action. Aluminum paint or black graphite may be used for finishing coats over a rust-inhibiting primer.

Paint should be applied only to a clean and perfectly dry surface, as the life of the paint film bears a direct relation to the condition of the surface of the pipe at the time it was applied.

Where severely corrosive conditions exist around air lines, sprinkling systems, water or gas lines, the petroleum base coatings containing a chromate rust inhibitor have proved very effective. This type of coating is usually protected with a spirally-applied reinforced fabric wrapper in direct contact with the undercoating. A service coat consisting of a combined petroleum and resin base material is applied over the wrapper for the purpose of sealing the seams against moisture penetration. All of these coats may be applied the same day, as no drying time is required.

Of the various metallic coatings that may be applied to pipe, galvanizing is the most common. Hot-dip galvanizing applied to steel and iron pipes usually provides satisfactory protection against atmospheric corrosion. It must be remembered, however, that under severe corrosive conditions, zinc, being anodic to iron, will corrode at a faster rate than iron, and too long a life should not be expected. This is especially true in an atmosphere containing sulfur dioxide. Under less severe conditions, zinc compounds are formed giving a natural protective coating and adding much to the life of the steel.

Under atmospheric conditions, the addition of a small amount of copper in steel has a marked effect in giving greater durability to this metal. This greater resistance to corrosion is due to the dense rust coating or film formed on its surface. Alloys containing a high percentage of chromium or chromium and nickel combined are highly resistant to corrosion but due to their high cost are only used in special work.

Underground Corrosion

There are many factors entering into soil corrosion, and for this reason any previous experience with the corrosive conditions of the soil is most valuable. There is also a wide variation in the rate of corrosion in different soils. Cinder fills contribute much to accelrate corrosion. The corrosive character of a soil depends mainly upon the soil water and its dissolved solids and gases, the dissolved solids being acids, bases, salts and organic compounds; the dissolved gases will consist of oxygen, carbon dioxide, hydrogen sulphide and sulfur dioxide in varying amounts.

Sand cast pipe has a natural protective iron silicate surface coating, fused on to the metal when the iron is cast. The rapid chilling given centrifugally cast pipe also tends to give the metal greater surface resistance. When the corrosion of cast iron is severe it undergoes a process known as graphitization. The corrosion follows the graphite flakes and the iron retains its original form, but it is soft and has little strength, while in iron and steel the corrosion occurs only on the surface.

When soil is in contact with dissimilar metals of a buried pipe system, severe, local bi-metallic corrosion often results and the pipe may fail with unexpected rapidity. Bimetallic corrosion can be reduced to a minimum by using the same metal throughout the entire piping system. The depth to which bimetallic corrosion penetrates is directly proportional to the ratio of the area of the less noble metal to that of the anodic metal exposed to the electrolyte, In the case of brass valves with iron and steel pipe, or brass-trimmed iron and steel valves, the effect of a small area of brass is distributed over a relatively large area of ferrous metal, and under most conditions does not cause serious corrosion.

Stray electric direct current often causes severe local corrosion in underground pipe systems. Usually this stray current is the result of defective ground or bonding in a near-by direct current circuit, which should be corrected. Protective coatings cannot be depended on for the prevention of stray-current electrolysis. Any failure in the coating on a pipe that is anodic, will concentrate the flow of current to

a small area on the pipe, which increases the rate of penetration at this point.

The extreme variation in the corrosive conditions encountered around railroad terminals and shops results in a wide range in the life of iron and steel pipe. These pipe lines, which are usually comparatively short, require materials and methods of protection particularly suitable for this type of work. Elaborate equipment for applying special protective coatings cannot normally be justified.

Piping is most easily and economically protected at the time it is installed. Steps should be taken at this time to improve the environment and to apply the protective coatings. Ground water is necessary for corrosion to take place in soil, and anything that can be done to improve drainage will reduce the rate of corrosion. Drainage may be improved by a bedding and back-filling of sand, gravel or crushed limestone. Limestone has an additional advantage by raising the pH value of the ground water in contact with the pipe. Clay also affords protection, but cannot be relied upon in a corrosive soil where the drainage is poor.

As in atmospheric corrosion, galvanizing has been the most generally used metallic coating for the protection of underground pipe, but only to a limited extent. The zinc coating will provide protection in only slightly corrosive soils. The threaded joints of the pipe must receive special attention.

A non-metallic protective coating should provide waterproofing and shielding from soil stress, as well as electrical insulation. The linseed oil paints are not generally used underground and should not be relied upon for permanent protection.

Asphaltic or bituminous coatings applied hot are widely used for coating of pipes to be used underground. No additional coating is normally applied to cast iron pipe, while steel pipe should have the additional protection of a spirally-wrapped fabric saturated with a bituminous material—if the soil conditions warrant. The fabric helps to prevent injury to the protective coating caused by soil stress or abrasion. In applying asphaltic bituminous castings it is important that the steel or cast iron pipe be free of all loose mill scale, and the pipe thoroughly clean and dry.

The reinforced petroleum base rust-inhibitive coatings have proved as effective in the prevention of corrosion of steel pipe underground as when exposed to the atmosphere. This type of coating has the advantage of being applied cold and by hand.

Probably the most permanent coating for underground protection is portland cement concrete which forms a film of alkaline solution in contact with the iron to inhibit corrosion. Concrete coatings are very durable and may be applied on a wet surface.

Cathodic protection of underground pipe systems is used to reduce corrosion of uncoated pipes and to insure continued protection with the coatings now available, since most all coatings will deteriorate or become damaged in time. Any break in the protective coating will tend to concentrate the corrosion activity to that point causing rapid failure.

To apply cathodic protection, auxiliary anodes are buried at suitable distances from the pipe line, through which a direct current is introduced into the soil. This current must be of sufficient magnitude to counteract any corrosion currents. The protective current may be obtained from a direct-current generator or rectified or by the use of galvanic anodes of magnesium, aluminum, or zinc. All types of the above anodes will be corroded in the process of protecting the pipe line and must be renewed at regular intervals. Where cathodic protection is applied to a new pipe line, it should be used in combination with a protective coating in order to reduce the current density requirements. On existing pipe systems which were not coated when installed, safe cathodic protection can be provided with higher values of current density.

Finally, it must be remembered that not all losses due to corrosion can be economically prevented. The choice of the method of corrosion control used, then, is dependent upon the required service life of the pipe, the life of unprotected pipe as compared with the increased life due to the protection, the cost of the protection, and the cost of renewing the pipe line. No one type of protection is suitable for all conditions; therefore, the factors controlling the corrosion must be studied carefully.

Discussion

W. E. Wilson (Int. Ry. of Cent. Amer.) opened the discussion by citing an example of how the Standard Oil Company prevents corrosion of pipe lines supported on buoys and extending out into the sea off Salvador. This is done by suspending a rod of magnesium under each buoy.

G. Martin (I.C.) pointed to that part of the committee report which states that protective coatings should be applied to a dry surface on the pipe. He advised that it was quite easy to misjudge the dryness of metal, especially a pipe carrying cold water and when the atmosphere is warm. If paint is applied over damp metal, corrosion may be accelerated by the coating. It may be more economical, he said, to let a pipe that has long durability go unprotected and replace it when necessary than to try to protect it.

C. A. Smith (I.H.B.) cited an instance where he installed about 3,000 ft. of air line of extra-heavy metal pipe. Desiring a long service life from this pipe line, he was careful in protecting it with a spirally-wrapped fabric saturated with a bituminous material. Also, the pipe was laid in a bed of sand. Within 11 months the air compressor was found to be overworking and when the line was uncovered it was found to have failed due to electrolysis. An electrician was present and tested the line for electrical currents, finding one volt. The entire line must now be renewed and will be given cathodic protection.

Precast Concrete Piles In Bridge and Pier Construction

Report of Committee

J. F. Warrenfells chairman), mast. carp., S.A.L., Savannah, Ga.; A. S. Krefting (vice-chairman) prin. asst. engr., M. St. P.&S.S.M., Minneapolis, Minn.; J. R. Showalter (vice-chairman), br. engr., M.P., St. Louis, Mo.; G. W. Benson, supt. br., C. of G., Macon, Ga.; M. Block, br. engr., I.C., Chicago; A. R. Harris, br. engr., C.&N.W., Chicago; F. W. Hutcheson, supv. b.&b., C.&O., Newport News, Va.; C. C. Lederer, insp., N.Y.C., Detroit, Mich.; W. L. McDaniel, vice-pres., Massey Conc. Prod. Co., Chicago; F. M. Misch, gen. b.&b. supv., S.P., San Francisco, Cal.; G. H. Paris, R.R. repr., Port Cement Assoc., Chicago; W. V. Parker, St.L.-S.W., Memphis, Tenn.; H. Montgomery, dist. mgr., Master Builders Co., Los Angeles, Cal.; R. Patterson, reg. v.p., Intrusion Prepact, Inc., Chicago; A. W. Schroeder, ch. engr., C.&E.I., Danville, Ill.; G. R. Webber, ch. carp., C.M.St.P.&P., Spokane, Wash.; J. R. Burkey, con. engr., Union Metal Mfg. Co., Columbus, Ohio.

The use of concrete piles at any site warrants a thorough survey on and below the surface. Borings should be made at frequent intervals to determine the lengths of the piles that are to be used. Under favorable conditions for boring, and where irregular formations of rock exist, some roads have found it economical to bore or sound each bent or pier location before the piles are cast. At the present per-foot cost of concrete piles, large savings may be effected by determining the proper length of all piles before casting any of them.

Location of the Pile Yard

The pile yard, or point where piles, slabs, and other concrete items are made, should be located where there is good drainage, solid ground for footings, proper topography for sufficient tracks and driveways, ample space for unloading and storing aggregates, cement, and steel, and space for storage for seasoning of the various items proposed to be made at the plant. Proximity to sources of supply for aggregates and cement, as well as the most favorable location for distribution of the finished product to the points of use, must also be considered in order to minimize unnecessary transportation. Like any other manufacturing enterprise, the proper selection of a plant location will have a direct bearing on the cost of the finished product.

Types of forms may vary widely, depending on the number of units to be made and whether the project is to be of short duration or a permanent set-up. Generally, the more carefully the forms are made, the lower the final cost will be if any reasonable number of units are to be made. Forms must be made so as to support the piles being cast without settlement and deflection so as to allow easy and rapid placement of reinforcing and concrete and proper vibration of the concrete. The forms should be made so as to be easily assembled and disassembled for rapid handling. Most experience has indicated the superiority of steel forms for precast concrete items. These forms, in any event, should be simple, sturdy, properly made, and supported,

For a permanent set-up, a concrete-paved casting yard will prove to be a good investment.

The number of forms required will be determined by the output desired from the plant, but a sufficient number must always be available so that production will not be halted while previously cast units are still green and the forms are not removed and available for the next pour. The number of forms for a permanent set-up will vary from the number required for a portable set-up where piles are cast on the job site.

Holding the Reinforcing

There are many methods of holding reinforcing for piles—in fact, about as many as there are people designing concrete piles and in general, they are all governed by the same rules. The steel must be held securely so that it will not be moved when the concrete is poured; and it must be in proper place after the concrete is poured. Generally, the devices for holding reinforcing fall into three classes—hooks, stools, and spacers, any of which will do the job required of them. Specifications of the American Railway Engineering Association cover the fastening and holding of reinforcing steel, and any method satisfactory under these specifications will give good results. The use of pieces of concrete, brick, or wood to hold reinforcing should not be permitted under any condition.

Pouring the Piles

In pouring piles it is of the utmost importance that the top end of the piles be cast exactly at 90 deg. to the axis of the piles to prevent chipping and breakage of heads during driving. It is also necessary that the piles be cast straight, since a slight deviation therefrom makes it extremely difficult to plumb the piles properly when the driving is begun.

Concrete mixes should be designed to attain the highest practicable strength, as determined by the ability to place the mix in forms, using vibrators. A minimum 28-day strength of 5,500 to 6,000 psi. should be attained. Some roads aim for as little as 3,500 psi., but the consensus of opinion holds to the higher strength.

As soon as the piles have taken the initial set, they should be covered so that there will be no drying out of the concrete. They should be kept covered for a suitable period, and sprinkled with water if the weather is such that there is a tendency for the concrete to dry out. Under no circumstances should the pile be allowed to cure without taking measures to control this phase of its manufacture. Piles that have cracks may well be the weakest spot in the bridge. This is especially true in those regions where there is salt water that might penetrate far enough to rust the reinforcing.

Whether the piles are cast on the job or at a central location, the rules for storing are the same. Piles should be handled and placed so as to avoid injury or overstress. If sufficient space and supports are available, the pile should not be stacked. But if it is necessary to stack them, they must be supported at the design support points, on firm and adequate bearings, and subsequent layers must be separated so as to avoid bending in either layer of the piles. The wood strips should be thick enough to insure sufficient clearance for placing slings.

If practical, piles should be distributed to their proper bent locations when they are unloaded, or stored. This, of course, is dependent upon conditions at the job site.

Loading Piles for Shipping

Concrete piles which must be shipped to another location must be handled with the greatest of care; piles may be loaded on flat cars or in gondola cars, but in either case, they must be securely blocked to avoid shifting in any direction while enroute. Hardwood blocking is preferable. AAR loading rules must be complied with to avoid damage to the piles and to other traffic. Piles should be loaded so as to facilitate the unloading, since in most cases railroad materials are handled with work trains, the cost of which is not negligible. Pick-up points should be plainly marked before the piles are loaded. Cars should be carefully inspected before piles are loaded in them. The weight of the pile can crush the blocking into the car decking badly enough to make it almost impossible to place unloading slings. When this happens, all adjacent piles should be moved and the pile should be rolled onto thicker blocking with jacks or bars, working only at the pick-up points.

Driving the Piles

In driving concrete piles, the right equipment is the most economical equipment. The hammer should be big enough to overcome the inertia of

the pile and yet not so big as to damage the pile under hard driving conditions. A set of leads will do much to expedite the driving, especially when the hammer is first set on the pile. It is much easier to plumb the hammer, and to keep it plumb, with leads. It is necessary to keep the hammer in accurate alignment with the axis of the pile to avoid spalling or splitting of the pile heads, especially during hard driving. A laminated timber cushion block must be used between the striking head and the top of the concrete pile, but this does not eliminate the necessity of keeping the hammer aligned with the pile.

Any necessary excavation should be done ahead of the driving for economy's sake as well as to feel out and remove any obstacles in the way that might damage the concrete pile. Under favorable conditions a water jet may be used to open a hole ahead of the driving. If frames are to be used to hold the piles, they will serve as a guide for the jet pipe, which will eliminate the possibility of the piles running off when they are set.

In most cases, frames or templets for holding the piles in a vertical position are practical. This is especially true where one machine is used for the driving and setting. The weight of the hammer, plus the weight of a pile, is usually too much load for a machine, which makes it necessary to set the hammer down while setting the pile. If repeated for each pile, this operation would be very expensive. Consequently, if frames are set, several piles may be set up for driving—the number depending on local train movements. Frames set at rail elevation and at the ground line will suffice. Where a three-pile bent is used, the timber chord of the old trestle may be lined up to serve as a frame for the center pile.

A jet of air, or water, may be used to control the direction of the pile while driving. The main objection to using a jet is the problem of handling it. It usually requires an unwieldly length of pipe for which provision for handling must be made.

Care must be taken at all times to avoid damage to the piles while driving. Solid foundations should be carefully located and care taken to avoid striking the pile after the foundation is reached.

Cutting Piles for Capping

Where piles cannot be driven to full depth, without excessive cost, and the penetration is satisfactory, some device for cutting off the pile must be employed, although this can best be avoided by determining the proper length pile for the job at hand. There are various methods in use for cutting off and stripping concrete piles, but the most popular seems to be the use of air tools. The air-operated "paving breaker" is a favorite for this work. Blasting is used only to a limited extent as it requires some skill. This, of course, requires the use of a drill for setting the charge. If the reinforcing steel is properly situated, a drill may be also used and the pile head snapped off with the pile line on the driver after the bars have been exposed and burned off. To avoid spalling of the concrete, a steel band can be made to fit the shape of the pile, with the top edge of the band placed at the point of cut-off. A small air-operated chipping hammer may be used to groove the pile at the cut-off point. This, too, will eliminate spalling to a large extent.

Probably the most important consideration is the economy in the proper use of the concrete pile. The concrete-pile structure is just coming to the front in many parts of the country, although its use dates back many years. The objections of the past are fast being overcome, principally the lack of equipment to handle the loads involved, since such equipment is restricted to this application. However, the rising cost of timber structures has placed the concrete pile in a more favorable position from a cost standpoint than ever before.

Discussion

G. S. Crites (B. & O., retired) agreed with the report that predetermining the lengths of concrete piles is necessary but he wondered how this could be done. Chairman Warrenfells stated that he uses a machine, which is a combination of an auger and a sounding rod, for this work. He said that while the machine requires about three or four men to load and unload, it can be operated by two men. In using this machine, he bores the holes at random, but he understands that some roads make soundings for each bent.

A. B. Wang (C.I.&L.) stated that he uses a commercial dry-sampling sounding method and makes a sounding for each bent. A. E. Bechtelheimer (C.& N.W.., retired) said his road uses core borings to determine the nature of soil material. Since it is desired to have the piling project 25 ft. below the

stream bed, he said, the borings are carried at least to that depth unless the soil conditions indicate the need for deeper borings to secure a more substantial bearing. The concrete piles are then ordered to the proper length.

H. A. Matthews (St. L.-S.F.) asked how much pressure should be used when jetting through quicksand. He had been using 150 p.s.i. reduced to ¾ in. Chairman Warrenfells said he used 350 p.s.i. reduced to ¾ in. and President Martens said he never used less than 350 p.s.i. The suggestion was made by T. M. von Sprecken (Sou.) that quicksand may require a larger jet pipe.

J. R. Showalter (M.P.) stated that he used a 2-in. auger for boring down 30 or 40 ft. but the method was not satisfactory for developing the desired information. He then tried a plan of stockpiling about 300 concrete piles ranging in length from 25 to 60 ft. Based on past experience obtained when driving timber piles at a bridge site, and the nature of the soil, he would estimate the pile lengths for a bridge and ship a carload of concrete piles, usually 2 piles each of 3 different lengths, which were driven as test piles. If the test piles proved to be of the wrong length, the proper length piles can be ordered and the foreman and his crew can work at other things until the new piles are delivered. Mr. Showalter expressed the belief that only by driving test piles can the proper lengths be determined to suit both soil and driving conditions.

How to Sell Accident Prevention To the Man in the Gang

Report of Committee

E. H. Blewer (chairman), asst. to supt. safety, N.Y.C., New York; H. M. Dick (vice-chairman), mast. carp., P.R.R., Harrisburg, Pa.; N. R. Tucker (vice-chairman), asst. divn. engr., T.&N.O., Lafayette, La.; F. G. Campbell, ch. engr., E.J.&E., Joliet, Ill.; S. L. Chapin, safety supv., S.P., San Francisco, Cal.; M. Coburn, sls, engr. (ret.), Philadelphia, Pa.; G. S. Crites, div. engr. (ret.), B.&O., Baltimore, Md.; H. D. Curie, mast. carp., B.&O., Garrett, Ind.; C. F. Gilbert, b.&b. supv., C.&O., Peru, Ind.; W. K. Manning, supv. brs., Erie, Port Jervis, N.Y.; Lee Mayfield, res. engr., M.P., Houston, Tex.; B. J. Ornburn, asst. ch. engr., C.M.St.P.&P., Chicago; D. T. Rintoul, gen. br. insp., S.P., San Francisco, Cal.; S. H. Shepley, asst. ch. engr., E.J.&E., Joliet, Ill.; J. F. Twomey, mast. carp., P.R.R., Chicago; G. Switzer, asst. div. engr., W.P., Elko, Nev.

The attention of industrial management is being focused more than ever before on accident prevention and its relationship to personnel and production. Accidents, whether they occur on or off the job, represent an important cause for lost time, and seriously interfere with production schedules. They cause a great deal of sorrow and suffering to the individual and his family. As a result many organizations have greatly intensified their safety programs in order to combat accidents.

It is an accepted fact that many accidents are the result of unsafe practices or unsafe conditions or a combination of both. Unsafe practices which are much more difficult to correct than unsafe conditions are unfortunately the cause of the greater proportion of accidents. Management has the basic responsibility of providing safe working conditions. It also must provide the means for a well-developed training program to educate supervision and employees in the correction of unsafe practices.

The railroads of our country were among the first to recognize these safety principles and their application to railroad operation. The vast improvements that have been made to the railroad plants through the years both for employee and public safety comprise a monument to this cause. Every railroad employee should be proud of this development in his industry and should wholeheartedly support the accident-prevention program of his railroad.

Some Basic Facts

In order that everyone in the bridge, building and water service departments will become thoroughly sold on the safety program, there are some basic facts to be observed:

1. There must be a thorough and complete educational program in order to bring the hazards of the job to everyone's attention and to empha-

size the corrective measures to be applied.

2. All the supervision must be entirely in accord with this program and *believe* in its application. (Note: Supervision includes every person who serves in a supervisory capacity from the president of the company down through the foremen and gang leader.)
3. The attitude of "new men" and "old timers" must be right for their participation in safety work.

In order to have a thorough and complete educational program there are many subjects involved. There is no way for you or me to point definitely at anyone and say, "We have saved this man's life or prevented him from sustaining a personal injury," though you probably all know of a certain isolated case. Statistics are used as the measuring stick for safety programs. You have all seen production schedules. Safety statistics are in the same category. They measure each department's, supervisor's and foreman's ability in safety work. They show where the good and bad spots are, and where the most attention should be concentrated.

Thorough Records Needed

The keeping of records showing the causes of accidents in all departments should be very thorough. These are necessary in order to point out to supervision what to look for and the remedies to be applied. Safety rule books are made up from these accident causes. Causes and remedies are the basic educational part of any safety program and should be thoroughly taught to all supervision. You may liken this to an apprenticeship served in any trade. There are various means of getting these points across such as:

Safety meetings with supervision—and they in turn with their men.

Personal contact by safety agents with the men.

Films—motion and sound-slide training films showing the correct procedures for the work.

Actual demonstration in work methods.

Safety literature, graphs, posters, home-made demonstrations.

Some railroads have home safety committees and family night safety rallies working toward establishing the basic principle of safety in each home.

With a thorough educational program in motion step No. 2 is reached —the training of the supervision and the application of these safety principles. By holding safety meetings with the supervision, the safety man is able to teach the causes of accidents and the remedies to be applied; but first it is necessary for all supervision from top to bottom to be "sold" on safety work. A supervisor, besides being a leader, must be a humanitarian. He must be fair and firm in his decisions, never showing any partiality. Men will generally "follow the leader" and work as he wants them to. A supervisor, when he is planning his work, should build safe work habits into the job. It is important that this be done and that everyone should know the correct procedure. You may always select the best of materials for your job, but have you considered that the workman is the most important of all these materials? With safe and efficient workmen you are assured of a good job, while the inefficient and unsafe worker is certain to cause untold delays and accidents.

The president of one of our large shipbuilding concerns made the statement that "a ship would never be perfect no matter how beautiful it looked or performed unless it was built without personal injury to any man who helped in its construction." We can all apply this to our own job because a good supervisor will plan the details of his work with complete thoroughness. He will be able to visualize the job step by step from the beginning to its conclusion. When such planning is done and the safe work habits are included in this planning then we are getting very close to a perfect job.

The responsibility for a perfect job rests with the supervisor and his ability to teach men the correct procedures in their work. His alertness is ferreting out unsafe practices and correcting them before an injury occurs is as much a part of his work as getting the work completed. There are many aids (previously mentioned) that are helpful to the supervisor in the training of his men. With a sound and proper program and his knowledge of accident prevention the supervisor is now ready to tackle the job of selling the man in the gang on safe work habits.

We railroaders have a tendency to class men as "new men" and "old timers." We draw a distinct line between them but we wonder, so far as accident prevention is concerned, if that is not a mistake. We all know of injury cases where "old timers" who have had many years of service have been seriously injured or killed. Can we say that a new man is more likely

to sustain an accident than the "old timer"? The only difference, from a safety standpoint, is that the new man with the right kind of supervision can be developed into a safe workman. Many an "old timer" is handicapped by bad work habits acquired over a period of years. These are very difficult to correct because of long usage. From the safety viewpoint we cannot make a distinction between a "new man" and an "old timer." Both must learn and practice safe work habits. Every man in a gang is an individual —his thoughts, habits, knowledge, skill and attitude differ from those of his fellow employees. It is necessary for the foreman to understand these traits and know the methods of dealing with them. Often one method, while fine for one man, is a failure with another.

The proper time to stress safe work methods to a man entering the service is when he is first employed. He must be told about the safety program and its relation to him; what the company is doing in safety work and how he is expected to become a part of this program. Of course, you cannot expect him to learn everything with one good five-minute talk. He must be coached and brought along just as a football coach brings his team forward.

Teamwork Important

He must be taught teamwork and its importance in safe work methods. He must be taught the hazards of the job and the precautions to be taken to avoid a personal injury. He must be given safety assignments to perform just as any other work, and in this way he will acquire a sense of responsibility in safety work. The foreman should watch for any unsafe practices, and explain the safe method to be followed. The worker's ideas should be evaluated in order to make him feel that he is important. When safety meetings are held the supervision should attend. If they do not the worker is justified in thinking that his presence is not required. What is important to one man is important to another.

An attitude of complete sincerity on the part of the supervisor or foreman in safety work is essential at all times. In other words, he cannot practice safety only when it suits his convenience; it breaks down a man's morale and lessens his respect for his superiors. When a man has formed unsafe work habits through long usage he can be corrected by persuasion and persistence on the part of the foreman. If a foreman will watch him performing his duties and make on-the-spot corrections of unsafe acts with an explanation of the safe method he will gradually bring the man around to safe work habits. That is a job of teaching and is worth every foreman's or supervisor's effort. A safe worker is an efficient worker and is the result of the training received from his supervisor. While we all cannot be experts in training, we can follow the basic steps which are:

1. Tell him how to do the job.
2. Show him how to do the job.
3. Watch him doing the job and correct if necessary.

By following these steps a foreman can teach a man to be a safe and efficient worker. He will be well rewarded for all his efforts by having a well-rounded gang. They will be loyal and cooperative. They will respect and trust his judgment. In short, they will FOLLOW THE LEADER.

Discussion

G. Martin (I.C.) stated that it is alright to teach a man how to do a job, but unless the man thinks of what he is doing, much of the teaching is nullified. He cited several examples of how thoughtlessness resulted in serious accidents. E. H. Barnhart (B. & O.) agreed with Mr. Martin adding that it is the little things that cause accidents. Mr. Barnhart read a short article entitled Common Sense in Safety, which emphasized that each man must look out for himself.

G. S. Crites (B. & O., retired) said that, at the beginning of the safety movement on the railroads, the bulk of the safety suggestions that were submitted by the men called for changes in physical conditions, rather than the development of a more safety-conscious attitude on the part of employees. He recalled one instance where he objected to a suggestion that a sign be posted on a station platform to inform the public that trains might approach from either direction. He was over-ruled and the sign was made and erected, but he never saw anyone pause to read it.

J. B. Kelly (Soo Line) said his records showed that accidents on his road had been reduced 60 per cent in the last five years by all departments except the B. & B. and the signal departments. He referred to a recent accident among his B. & B. forces where a painter used a bar to pry up a loose plank. When the plank fastening sud-

denly gave way, relieving the strain on the bar, the painter caught his feet on the rail and fell into a hopper. He said that perhaps the supervisors of track may be able to teach the supervisors of B. & B. and signals something about safety.

W. A. Huckstep (M.P.) observed that many signs and posters have been erected in the name of safety and remain in place without change. If the signs are re-worded, mounted in a new place, or even repainted, he thought that more people would read them. J. A. Jorlett (Penna.) agreed with this observation and said his road has an illuminated sign that has a new slogan every year. Chairman Blewer agreed with what was said about signs. He is a great proponent of posters and believes that they should be placed on bunk cars and even on tool boxes. Permanent signs, he said, should be kept freshly painted, and posters should be replaced frequently with newer ones.

E. L. Collette, Sr. (St.L.-S.F.) said that accident prevention begins at home. Chairman Blewer agreed to this and stated that his road, the New York Central, had printed a booklet containing over 6,000 pointers on home safety. He also believes that each man in a crew or gang should have a day when he should look for unsafe practices and call them to the attention of others. This way, he said, every man can actively participate in the safety program. He also pointed out that, when a man is hurt at home, his whole gang is hurt because a new substitute worker must be broken in. If safety in the home is put across to a workman, he is going to be more safety-minded on his job.

Mr. Huckstep cited an instance where an employee had an argument with his wife before leaving home. Because his mind was not on his work, his hand came in contact with the moving parts of a machine, causing him to lose his fingers. Chairman Blewer said that one of the pointers listed in the N.Y.C. booklet on home safety was to the effect that a man should leave his home in a good frame of mind. He then cited an instance where a man was killed because he became careless while thinking of his wife's death which occurred exactly one year to the day of his own death.

Construction and Maintenance of Low-Level Passenger Platforms

Report of Committee

L. C. Winkelhaus (chairman), arch. engr., C.&N.W., Chicago; H. T. Lord (vice-chairman), b.&b. mast., C.P., Kenora, Can.; Eldee Park, Jr. (vice-chairman), dftsman., M.P., Houston, Tex.; E. H. Barnhart, div. engr., B.&O., Garrett, Ind.; M. D. Carothers, asst. ch. engr., G.M.&O., Bloomington, Ill.; A. M. Glander, ch. carp., C.M.St.P.&P., Mason City, Iowa; H. P. Greene, mast. carp., P.R.R., Columbus, Ohio; K. E. Hornung, architect, C.M.St.P.&P., Chicago; R. S. Miller, bldg. supt., C.R.I.&P., Chicago; W. C. Oest, prin. asst. engr., F.W.&D.C., Ft. Worth, Tex.; L E. Peyser, arch., S.P., San Francisco, Cal.; C. J. Shopland, asst. engr. b.&b., C. of Vt., St. Albans, Vt.; L. C. Smith, div. engr., C.&N.W., Madison, Wis.; K. P. Wilson, asst. supt. b.&b., C.&O., Hinton, W. Va.; R. W. Humphreys, div. engr., N.P., Missoula, Mont.

There is no portion of a railway property that is more in the public eye than the passenger platform. It is used by all patrons using train service and is subject to close scrutiny while such people are waiting for trains. A clean and well-maintained platform cannot fail to make a lasting impression upon the traveling public; and it has a certain advertising value which should not be overlooked.

There are various kinds of wearing surfaces for platforms which may be considered, such as wood, screenings, brick, concrete, or various asphaltic compounds. The selection for any particular location depends upon the kind and volume of traffic, importance of the station for passenger traffic, climatic conditions, permanence, availability of materials, and cost.

In the northern climates, platform surfaces become slippery in freezing weather, and those with a smooth, hard surface are affected more readily than others. On the other hand, platforms with smooth, hard surfaces are better for trucking baggage, mail, and express; and they are more easily cleaned of snow and ice. Platforms

constructed of wood or screenings, are much more difficult for trucking, and are usually not as clean, nor as even as the hard-surfaced type.

The distance from center line of track to platform edge, or curb, varies with the particular railroad involved, and also with the clearance requirements of the various state codes. Many railroads have standardized on a distance of 5 ft. 6 in. from the center line of track to platform edge; and on a distance of 8 in. from top of rail to top of platform. Other railroads have standardized on a distance of 4 ft. 6 in. from the center line of track to platform edge, and 4 in. from the top of rail to top of platform; and some railroads construct platforms level with top of rail. Whatever the standard may be on the various railroads, the clearance must comply with the clearance code of the state in which the structure is located.

The width of platform for most wayside stations is usually 12 ft., except immediately in front of the station building, which is ordinarily set back several feet. This setback varies considerably on different railroads.

Careful consideration should be given to drainage of station platforms. Where possible, the slope for drainage should be away from the track. Where the slope is towards the tracks, suitable drainage should be provided.

Wood Platforms

In the original construction of the smaller stations, wood platforms were almost universally provided, and many of these platforms are still in use. Such platforms were usually 10 ft. to 12 ft. wide, extending in each direction from the station building, and a similar width at each end of the building.

Wooden platforms are usually constructed with the joists running parallel to the track, and with the planking placed at right angles to the track. The sills, on which the joists rest, should be supported on pile stubs, or mud plank.

It is considered more economical to use 2-in. plank and to design the substructure accordingly, using a live load of not less than 200 lbs. per sq. ft. for figuring timber sizes. The plank may be 8 or 10 in. wide and laid with a small space between adjacent plank. Joists, caps, or sills, should be of treated material, and of such size and spacing as determined by the design.

Maintenance on wood platforms is heavy. The planking soon shows wear from trucking and other traffic; some planks are broken, or splintered, and when these are replaced with new material, the surface of the platform becomes uneven, often presenting stumbling blocks for passengers. This type of platform also creates a serious fire hazard.

The cost of wood platforms does not compare favorably with the more permanent kinds of platforms due to the high cost of lumber and the great amount of labor required for such construction.

Platforms of Screenings

In many instances, where wooden platforms have worn out and required replacement, the practice has been to remove the platform entirely and place filling material with a topping of cinders, gravel, stone screenings, chats, or other suitable material.

The procedure is to place timber curbs, preferably creosoted material. Curbs should be at least 4 in. thick, with the bottom placed level with top of tie, and the top at such level above top of rail to meet the standard of the particular railroad involved. Curbs should rest on pile stubs, cedar posts, or a substantial mud sill.

In the construction of such platforms, it is desirable to provide tie rods to hold the curbs in line, and such tie rods should be spaced approximately on 6-ft. centers. Tie rods are usually threaded at both ends and are furnished with steel plates and nuts; they are at least ¾ in. in diameter, and the steel plates are about 6 in. by 6 in. by ⅜ in. Inasmuch as the tie rods are buried in the filling material, they should be galvanized or thoroughly coated with asphaltum, or wrapped with some asphaltic material in order to preserve them.

After curbs and tie rods are in place, filling material is placed. This may be crushed stone, gravel, cinders, or sand, or a combination of these materials. Filling material should be well soaked with water and thoroughly rolled, or tamped. The topping course of stone screenings, chats, or other suitable material is then applied in a course of 6 in. or 8 in. thick.

Platforms of screenings are not the best that can be provided, but they are economical in initial cost. Bad spots will develop, due to a tendency to soften under wet-weather conditions. Trucking is much more difficult on such platforms, especially in the spring of the year due to weather conditions. They are objectionable because of the dirt that is tracked into the stations

and coaches by the passengers; also, because of dust raised by wind and rapidly moving trains, which results in the station building becoming dirty.

Brick platforms were generally constructed at the larger stations, and where permanence was desired. These platforms have a number of advantages over other platforms inasmuch as they present a hard and comparatively smooth surface; they can be readily cleaned of snow and ice; if bricks are broken, or should settlement occur in spots, the brick can be taken up and relaid; if the grade is raised, and it becomes necessary to adjust the platform level, the brick can be salvaged and relaid.

Curbs for brick platforms may be of wood, cut stone, or concrete. Wood curbs are usually of creosoted material, 6 to 8 in. thick, and of a depth to suit elevation of top of platform with respect to top of rail. Anchor or tie rods should be provided in the same manner as for screenings platforms.

In former years, cut-stone slabs about 5 in. thick by 30 in. deep and 4 or 5 ft. long, were used for curbs for brick platforms. These slabs were set firmly in place and all back filling thoroughly tamped. These stone curbs gave good service and many are still in use. Some railroads use precast concrete slabs for curbs and these are set in the same manner as the stone slabs. Such slabs are usually 6 in. thick, 30 in. deep and 4 ft. or 5 ft. long.

At the present time, it is the practice to construct concrete curbs. The general design calls for a width of 5 or 6 in. at the platform level and 12 in. at the base; the track side of the curb being vertical and the rear side tapered particularly near the top so that any heaving of the bricks will exert less force on the curb. The bottoms of the concrete curbs should be at least 18 in. below the top of tie. They should be built in sections of about 6 ft. in length and expansion material placed between such sections. To provide for drainage, weep holes, about 2 in. in diameter and spaced on 4-ft. to 6-ft. centers, may be provided.

It is essential that brick platforms be constructed on a well-prepared base composed of crushed stone, gravel, cinders, or sand, or a combination of these materials. Such materials must be flooded with water and well tamped, or rolled, in order to eliminate as much settlement as possible.

The preferred brick to use for station platforms is a vitrified shale brick about 3 in. thick, 8 in. long and 4 in. wide. Bricks are laid flat on a 1-in. sand cushion, with broken joints, and in straight lines across the platform at right angles to the curb. After the bricks are laid, the surface is thoroughly rolled with at least a 500-lb. roller. Then, all joints are filled with screened mason sand, clean and dry, and, finally, a thin layer of sand is left over the entire surface of the platform, more or less of which will work into the joints. A well-laid brick platform will last many years, and will require very little maintenance.

Concrete Platforms

It is the present-day practice, where permanence is desired as well as appearance, to construct concrete platforms. Such platforms, when properly constructed on well-prepared base, give excellent service and present an attractive appearance.

The earlier concrete platforms were more or less of a failure, due primarily to improper concrete mixtures, lack of expansion joints, and not enough attention paid to preparing the base, including drainage for same. Some of the results of such construction were settlement and contingent cracking of concrete surface, causing unevenness in the platform and surface projections.

The preparation of a firm base for concrete platforms is more essential than for a brick platform. The same materials and procedure should be followed, but more attention given to the work. This feature cannot be stressed too highly.

It is preferable to construct curbs integral with the platform slab. The bottom of the curb should be about 18 in. below the top of tie, and the thickness should be approximately 6 in. at that point. The track side of the curb, of course, is constructed vertical, while the inner face slopes upward to the underside of the platform slab, where curb construction should be about 18 in. thick.

Concrete platform slabs are usually constructed at least 6 in. thick, and reinforced with welded wire mesh in 6-in. squares and No. 9 wires in each direction. The reinforcing mesh is bent down into the curb construction, and it is desirable to provide additional reinforcing in the curb, using ½-in. bent bars on 12-in. centers along the outer face of the curb and extending into the slab a couple of feet.

Expansion joints must be provided at intervals of approximately 35 ft.;

thus slabs can be constructed in alternate sections of this length. At these expansion joints, ¾-inch dowels 2 ft. long, are provided on 24-in. centers; one end of each dowel is oiled and fitted into a metal expansion tube. A premoulded expansion joint filler is then used to fill the joint completely. Another method, to allow for expansion, is to dip one end of the dowels into hot asphalt and allow to cool before installation; or wrap one end of each dowel with asphalt felt.

Concrete-Brick Platforms

Brick platforms usually begin to show failure at the curbs and in the portion of the platform adjacent to the track. Some railroads have made repairs by removing the old curbs and a portion of the brick platform along the track, and reconstructing with a concrete curb built integral with a 3 or 4-ft. strip of concrete platform. This construction presents a pleasing appearance and also provides a definite line of demarkation for passengers and trucking operations.

Asphalt-Mastic Platforms

Occasionally, brick or concrete platforms are in such a condition that it becomes necessary to provide a new surface. There are a number of asphaltic compounds on the market that are suitable for such repair work. Such material is applied with a trowel and varies in thickness from ½ in. to ¾ in. No special preparation of the old platform is necessary and it can be placed with very little interference with station operations. There are no joints to contend with; hence, a very smooth and resilient platform surface is obtained.

It is recommended that the application of any asphaltic topping material should follow strictly the specifications of the manufacturer of the material.

Bituminous Concrete Platforms

Bituminous concrete platforms are being constructed quite extensively on the various railroads, particularly at the smaller wayside stations where the traffic is not too heavy. Such platforms are receiving favorable comment from the traveling public.

In practically all platforms of this type, the curbs are prepared as for screenings, brick, or concrete platforms. The platform area is then filled with crushed rock, or coarse gravel to within 2 in. of the finished surface. In some instances, bituminous concrete, composed of crushed rock, stone dust, and asphalt, is used for this base. At some locations, bituminous material is sloped to the ends of the ties without a curb.

After the base is placed and properly rolled, a 2-in. wearing surface of hot mixed asphalt mastic is placed. In lieu of hot mixed asphalt, a wearing surface of natural asphaltic rock, cold-mixed with a small amount of road oil, may be used. The finished surface is often dusted with Portland cement to produce a light color. It is reported that such a wearing surface does not soften in the summer time, and steel tired baggage trucks do not dent the surface.

One of the larger western railroads constructed asphalt mastic platforms in its trainshed more than 40 years ago. These platforms have required but little repairs, although subjected to heavy traffic, both pedestrian and trucking. While these platforms are more or less under cover, they have been exposed to all the weather elements, except direct rays of the sun.

Conclusion

In compiling the foregoing report, it has been the endeavor to describe the various types of platforms so that the designer of station facilities may have a selection to meet various conditions. Platforms are an essential part of passenger station facilities, and a well-constructed platform is an asset to any railroad.

Discussion

E. H. Barnhart (B. & O.) opened the discussion by saying that unless concrete curbs are sufficiently anchored, platform truck loads tend to push them toward the track. He found that curbs with a 12-in. top and a 24-in. depth gave better performance than those with a 5-in. top. John Ryden (G.C.L.) agreed that the precast curbs on his road, which were 6 in. wide at the top, 30 in. deep and extend 8 in. above top of rail, were inclined to be pushed toward the track, causing reduced clearances. In repairing them, he said, he takes out an old section of the curb and pours a new one in its place but with tie rods extending back from it. G. S. Crites (B. & O., retired) stated that curb slabs should be keyed together and mentioned a platform curbing poured in place, dowelled together, and with a step in the rear instead of a slope,

which he installed in 1926. This curb is just as effective as when new, he said.

Mr. Crites deplored the use of stone screenings or cylinders as surfacing for platforms, saying that no mechanical units can be used on them for cleaning off snow or dirt. He recommended a hard-surfaced platform. Mr. Barnhart said that a troweled asphalt-mastic surface ½ in. to ¾ in. thick applied in repairing concrete or brick platforms was too thin, his view being that the new surface should be 2 in. thick and then rolled.

President Martens related that a brick platform constructed at San Bernardino, Cal., had the sand particles removed from the joint interstices by ants and the only way he could cope with the activities of those insects was by placing a black-top surface, from ½ in. to 3 in. thick, and then rolling it. H. W. Routenberg (B. & O.) stated that brick had a bad characteristic when used on a sand cushion for platforms having a butterfly-type canopy with center columns. The trouble is that platform trucks generally follow the same path over these platforms, causing them to wear badly.

When W. A. Huckstep (M.P.) asked if anyone could suggest a better surface than concrete for platform trucking, Mr. Crites answered that concrete with a bituminous surface was the best for this purpose. Mr. Huckstep did not believe that a bituminous surface would be durable in the southern states, to which Mr. Crites agreed but suggested that substituting a tar for the bituminous surface would no doubt work out better in the warmer climates. President Martens stated that he found a hot-mix (plant-mixed) bituminous coating for brick platforms satisfactory even where warm temperatures prevail.

Installing and Maintaining Waterproofing On Ballast-Deck Bridges

Report of Committee

F. J. A. Leinweber (chairman); b.&b. mast., C.N., St. Thomas, Ont., J. S. Hancock (vice-chairman), br. engr., D.T.&I., Dearborn, Mich; R. C. Baker, supv. b.&b., C.&E.I., Danville, Ill.; M. Block, engr. brs., I.C., Chicago; R. J. Hardenbergh, dftsman, N.Y.C., Detroit, Mich.; J. E. Heck, supv. b.&b., C.&O., Ashland, Ky.; H. T. Johnson, asst. mast. carp., P.R.R., Wilmington, Del.; C. L. Le Duc, Acorn Refining Co., Chicago; B. J. Many, B. J. Many Co., Chicago, G. J. Morris, Elec. Tamping & Eqpt. Co., Cambridge, Ohio; C. E. Smith, v.p., N.Y.N.H.&H., New Haven, Conn.; T. M. von Sprecken, asst. to ch. engr., Southern, Washington, D. C.; F. W. Widrig, designer, N.Y.C., Detroit, Mich.

Types of ballast-deck bridge floors that require waterproofing are usually of the steel deck or concrete type, the latter being most common. In order to prolong the service life of these structures, it is essential that the ballast floor be protected from water, brine, and other foreign agents that attack and hasten deterioration and disintegration of materials used in their construction.

Concrete is known to have a strong tendency to absorb water either by capillary attraction, by gravitation or by hydrostatic pressure, causing any voids in porous concrete to be filled as well as the voids in the coarse materials used for aggregates, and in many cases an agency is introduced which is sometimes destructive, thereby reducing the service of the structure. Water in contact with concrete is a definite source of deterioration due tc its solvent action, causing disintegration occasioned by alternate freezing and thawing. Concrete used for a ballast deck should be of a well proportioned mix containing some integral compound if considered necessary, and well vibrated so as to produce a dense and impermeable concrete, the top surface of which should be brought to a smooth finish with proper slopes to drainage outlets.

Good Drainage Important

Ballast-deck bridges demand attention in their design. They should be designed and detailed to present a natural gravitational watershed with sufficient slope to ensure the discharge of water to drainage outlets, avoiding, wherever possible, depressions, pock-

ets, blind gutters, etc. Care should also be taken to have the drainage outlets placed in such a location and extended sufficiently beyond the underside of the slab or structure that water so discharged does not come in contact with the underside of any steel or concrete that may be exposed to water or brine drippings from these drains, as it will cause damage to the supporting masonry or steel structure.

It is also necessary that care be taken in the detail and design of all joints required for expansion, contraction or deflection. Where the use of flexible strips of a non-corrosive metal are to be embedded in the concrete, they shall be placed in such a position that they will readily provide flexibility of the waterproofing at these locations and can be sealed effectively where the waterproofing membrane terminates, such as along the webs of girders.

Membrane Waterproofing

The mebbrane method of waterproofing is mostly used for ballast-deck bridges and is a treatment designed to render concrete or other structure impervious to water. Experience indicates that positive waterproofing is best accomplished by this method, in which a protective envelope is applied to the surface required to be waterproofed .This membrane is usually composed of impregnated felts and a fabric bonded together with hot mopped bitumen.

The application of these materials should in all cases be under the supervision of a foreman who is familiar with this type of work, or should be made by an experienced waterproofing firm which has done work of a similar nature.

Application

The clean, dry surfaces to be waterproofed should be given one or two applications of a primer, a thin scientifically compounded bitumen solution with a fairly quick drying quality. This primer should be brushed or mopped on concrete and metal surfaces to fill any existing pores and prevent moisture absorption, also to provide anchorage for subsequent bituminous applications. This primer is usually applied cold, although some primers are heated for their application. On surfaces that cannot be dried the application of a layer of asphalt-saturated asbestos-felt waterproofing should be laid with joints lapped at least 3 in. on the sides and 6 in. at the ends. To this primed or prepared surface various amounts of impregnated felts and fabrics bonded together with hot mopped bitumen may be applied to make up the specified envelope or membrane.

Practice varies on the different roads as to the use of felts and fabrics, felts being used primarily for water resistance and fabrics for tensile strength. A membrane consisting of three-ply fabric and four moppings of bitumen together with the primer or base felt, will, under ordinary conditions, give satisfactory results. Most failures recorded are usually traceable to poor design or faulty workmanship.

This waterproofed envelope or membrane should be protected from open elements and the action of the ballast. This is accomplished by one of the following methods:

(a) A layer of poured-in-place asphalt mastic not less than 1½ in. thick.

(b) A layer of asphalt blocks or asphalt plank not less than 1 in. thick laid in an extra-heavy mopping of asphalt, with the joints filled with hot asphalt.

(c) A layer of reinforced cement mortar or concrete not less than 2 in. thick.

(d) A course of hard burned brick not less than 2¼ in. thick with joints filled with hot asphalt, except that when laid in a vertical wall or steep slope, cement mortar should be used.

Leakage Over Backwalls

One road has had difficulty with leakage over backwalls on a steel deck span and, in order to overcome this problem, it is using an apron and tail-plate assembly with membrane waterproofing, which completely covers the top and rear face of the backwall down to a depth just below the level of the bridge seat.

In detail, this road is using an apron plate of the same thickness as the existing floor plate, and electrically welded to the floor plate. To this apron plate is then welded a 3/16-in. tail plate which is field sprung so as to fit tight to the rear face of the backwall at its lower end. The floor plate, apron plate and tail plate are then covered with membrane waterproofing Types (a) or (d), according to A.R.E.A. Specifications for Membrane Waterproofing — 1942. To protect this membrane a layer of asphalt-impregnated asbestos-felt is then applied.

Care is taken that the welded joint and the lower end of the tail plate are overlapped considerably, preferably a minimum of 1 ft. A slush coat of asphalt is then applied over the top surface of this treatment. To carry the water away, which may drain over the backwall, a perforated pipe is placed behind approximately 3 ft. below the top of the backwall and slope to one end for water disposal. The perforated pipe is then covered with porus backfill and ballast is replaced to original grade.

"Duck's-Back" Construction

Recently a most thorough and effective waterproofing repair job above and below ballast was carried out on the steel deck, of the double-track, 977-ft. steel arch and approach span bridge on the Michigan Central (New York Central) line which spans the Niagara River gorge between Niagara Falls, Ont., and Suspension Bridge, N. Y. The fouled condition of the ballast, due primarily to sand used by locomotives hauling transfer runs in both directions at slow speeds to permit checking of cars by customs, dictated its removal.

Taking one track out of service at a time, the old ballast was removed by special tools and gang organizations, and thoroughly cleaned off by chipping, sweeping and air blasting of the existing waterproofing on the deck plate. To this a fresh mopping of oxidized asphalt (Imperial 140 F.S.P.) was applied after repairing and renewing of the drainage outlets and downpipes was completed. Drainage pipes are placed 10 ft. apart and extend above the top of ballast to a point below the steelwork of the bridge. At the top end and immediately above the waterproofing, these pipes are slotted to allow the deck surface water, as well as the water that seeps through the ballast, to escape.

Stone Ballast Unloaded

Sufficient new stone ballast was unloaded by a small crane to provide a depth of 4-in. under the new sawn ties that were placed, and the track was relaid and surfaced up to approximately one inch below the final grade, then tamped with electric tie tampers and brought up to final grade. The guard rails were then replaced and the track put into service so that work coud be started on the westward track, which was completed in a similar manner, taking extreme care in removing the old ballast so as not to foul the newly-placed ballast on the completed eastward track. Both tracks were then retamped and brought to finished grade after being in service for a few days, and the stone was formed by use of a template to a point 2 in. below the proposed finished grade of the final asphalt paving to be applied.

Applying the Asphalt

The asphalt paving material was then unloaded by a small crane. This material was supplied by a ready-mixed paving company and consisted of 60 per cent ¼-in. material and 40 per cent ranging from ⅛ in. to 200 mesh, to which was added 10 imperial gallons of 90-100 penetration asphalt, and 3 gal. of Diesel fuel oil as a cut back. This material is readily handled and was spread over the stone ballast to a depth of 1 in. above the finished top and then compacted to grade, provided a 2 in. surface over the stone ballast, and sloped to gutters so as to carry water to outlets and down pipes. Special tools were made to tamp this material by welding various shaped plates to tamping bits, so that tamping could be accomplished under the running rails and between the ties, as the material was sloped from 1 in. below the top of tie inside rail to 2 in. below top of the tie on outside rail.

After the paving had been completed and the entire deck surface cleaned, the paving, ties, guard rails and running rails were given a spray coat of bitumen, with a coating of fine sharp sand applies to the ties and paved surface, this sand being brushed on immediately after the spraying to prevent the bitumen from flowing toward the gutters.

Conclusion

Membrane waterproofing requires protection from the sun, and if left exposed to the elements it will dry out and deteriorate. Hot or cold mastic, concrete, brick or asphalt plank can be used for protection. If concrete is used it is recommended that it be a mix with a coarse aggregate having a maximum size of ⅜ in. and that wire-mesh reinforcing be used. A breaker sheet is sometimes used between the membrane and the protection coat. This breaker course is useful in case the protection course requires renewal before it is necessary to remove the membrane, as it is practically impossible to remove the protection coat without damaging the waterproofing when

the waterproofing and protection are built integral.

It should be emphasized that the quicker water can be disposed of the better. Ballast tends to disintegrate and become fouled to the extent that water cannot quickly reach the drainage outlets, in which case consideration should be given to placing flat-base or round perforated drains at strategic locations to facilitate quick drainage of water.

Construction joints are hard to waterproof effectively, and consideration should be given to the use of open joints permitting water to escape more freely, rather than design a waterproof joint that looks well on paper but is difficult to place and that may not be effective. It is to be remembered that more disintegrated concrete will be found at construction joints than at cracks in concrete that have opened up after the structure is completed.

Tests are now being made by the A.R.E.A. on many different kinds of liquid concrete waterproofings that are now being sold to waterproof concrete surfaces without the use of membrane. It is hoped that when these tests are completed and the results made available, we will know better what to use to protect concrete surfaces.

Discussion

G. S. Crites (B. & O., retired) referred to the example of the waterproofing job at Niagara Falls in the report and asked why asphalt paving was put over the ballast and around the ties. This was answered by one of the committee members who said that the paving provided a quick run-off for precipitation.

G. W. Benson (C. of Ga.) told of an expressway that was waterproofed in 1923 as recommended in the committee report. In this case almost all of the water drained over the sidewalls. Since the work was done only one small leak developed and this occurred where some soft rock had been used as ballast and gave away.

R. A. Van Ness (A.T.&S.F.) stated that he had several bridges with timber ballasted floors which had been waterproofed and then covered with unsaturated asbestos paper. These bridges, after 40 years of service, do not have any leakage through the decks.

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	1899-1900	1900-1901	1901-1902	1902-1903
President	Aaron S. Markley	W. A. Rogers	W. S. Danes	B. F. Pickering
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	H. D. Cleaveland	W. E. Smith	C. A. Lichty	W. O. Eggleston
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	1903-1904	1904-1905	1905-1906	1906-1907
President	A. Montzheimer	C. A. Lichty	J. B. Sheldon	J. H. Markley
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	W. O. Eggleston	A. E. Killam	A. E. Killam	A. E. Killam
	A. E. Killam	H. Rettinghouse	J. S. Lemond	J. S. Lemond
	R. C. Sattley	J. S. Lemond	C. W. Richey	C. W. Richey
	H. Rettinghouse	W. H. Finley	H. H. Eggleston	H. H. Eggleston
	J. S. Lemond	C. W. Richey	F. E. Schall	B. J. Sweatt

BRIDGE MODERNIZATION AT CAIRO

• The year 1951 will see the completion of a new steel superstructure for the Illinois Central's 61-year old, main line bridge over the Ohio River at Cairo, Illinois.

American Bridge Company was the logical choice to perform the major construction feat of building the new 12-span superstructure on the original piers with a minimum of interruption in traffic.

The first span of the old 9-span bridge was rolled off its piers onto temporary falsework and new 518′, 1,700-ton span moved into position and opened to service after a traffic interruption of only 20 hours! Then the old span was launched like a ship into the river 100 ft. below for easy removal.

While this is the first time this procedure has been used on a job of such magnitude, it is a typical example of the part American Bridge Company is playing to help our vital railroad systems meet the needs of growing America.

INTERESTING FACTS

- 6 spans, 197′ 7″
- 4 spans, 400′ 11½″
- 2 spans, 518′ 11″
- Steel used, 10,000 tons.
- Erecting procedure: Illinois Central R.R. and American Bridge Company.
- Consulting Engineers: Modjeski and Masters.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **AMERICAN BRIDGE**

UNITED STATES STEEL

	1907-1908	1908-1909	1909-1910	1910-1911
President	R. H. Reid	J. P. Canty	H. Rettinghouse	H. Rettinghouse
1st V.-Pres.	J. P. Canty	H. Rettinghouse	J. S. Lemond	F. E. Schall
2nd V.-Pres.	H. Rettinghouse	F. E. Schall	F. E. Schall	A. E. Killam
3rd V.-Pres.	F. E. Schall	J. S. Lemond	A. E. Killam	J. N. Penwell
4th V.-Pres.	W. O. Eggleston	A. E. Killam	J. N. Penwell	L. D. Hadwen
Secretary	S. F. Patterson	S. F. Patterson	C. A. Lichty	C. A. Lichty
Treasurer	C. P. Austin	C. P. Austin	J. P. Canty	J. P. Canty
Executive Members	A. E. Killam	J. N. Penwell	W. Beahan	T. J. Fullem
	J. S. Lemond	Willard Beahan	F. B. Scheetz	G. Aldrich
	C. W. Richey	F. B. Scheetz	L. D. Hadwen	P. Swenson
	T. S. Leake	W. H. Finley	T. J. Fullem	G. W. Rear
	W. H. Finley	L. D. Hadwen	G. Aldrich	W. O. Eggleston
	J. N. Penwell	T. J. Fullem	P. Swenson	W. F. Steffens

	1911-1912	1912-1913	1913-1914	1914-1915
President	F. E. Schall	A. E. Killam	J. N. Penwell	L. D. Hadwen
1st V.-Pres.	A. E. Killam	J. N. Penwell	L. D. Hadwen	G. Aldrich
2nd V.-Pres.	J. N. Penwell	L. D. Hadwen	G. Aldrich	G. W. Rear
3rd V.-Pres.	L. D. Hadwen	T. J. Fullem	G. W. Rear	C. E. Smith
4th V.-Pres.	T. J. Fullem	G. Aldrich	C. E. Smith	E. B. Ashby
Secretary	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Treasurer	J. P. Canty	J. P. Canty	J. P. Canty	F. E. Weise
Executive Members	G. Aldrich	G. W. Rear	W. F. Steffens	W. F. Steffens
	P. Swenson	W. F. Steffens	E. B. Ashby	S. C. Tanner
	G. W. Rear	E. B. Ashby	S. C. Tanner	Lee Jutton
	W. F. Steffens	C. E. Smith	Lee Jutton	W. F. Strouse
	E. B. Ashby	S. C. Tanner	W. F. Strouse	C. R. Knowles
	W. O. Eggleston	Lee Jutton	C. R. Knowles	A. Ridgway

	1915-1916	1916-1917	1917-1918	1918-1919
President	G. W. Rear	C. E. Smith	S. C. Tanner	Lee Jutton
1st V.-Pres.	C. E. Smith	E. B. Ashby	Lee Jutton	F. E. Weise
2nd V.-Pres.	E. B. Ashby	S. C. Tanner	F. E. Weise	W. F. Strouse
3rd V.-Pres.	S. C. Tanner	Lee Jutton	W. F. Strouse	C. R. Knowles
4th V.-Pres.	Lee Jutton	F. E. Weise	C. R. Knowles	A. Ridgway
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Executive Members	F. E. Weise	W. F. Strouse	A. Ridgway	J. S. Robinson
	W. F. Strouse	C. R. Knowles	J. S. Robinson	J. P. Wood
	C. R. Knowles	A. Ridgway	J. P. Wood	A. B. McVay
	A. Ridgway	J. S. Robinson	D. C. Zook	J. H. Johnston
	J. S. Robinson	J. P. Wood	A. B. McVay	E. T. Howson
	J. P. Wood	D. C. Zook	J. H. Johnston	C. W. Wright

	1919-1920	1920-1921	1921-1922	1922-1923
President	F. E. Weise	W. F. Strouse	C. R. Knowles	Arthur Ridgway
1st V.-Pres.	W. F. Strouse	C. R. Knowles	A. Ridgway	J. P. Wood
2nd V.-Pres.	C. R. Knowles	A. Ridgway	J. S. Robinson	J. S. Robinson
3rd V.-Pres.	A. Ridgway	J. S. Robinson	J. P. Wood	C. W. Wright
4th V.-Pres.	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.			F. E. Weise	F. E. Weise
Directors	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
	A. B. McVay	A. B. McVay	J. H. Johnston	Maro Johnson
	J. H. Johnston	G. A. Manthey	E. K. Barrett	O. F. Dalstrom
	E. T. Howson	E. T. Howson	F. C. Baluss	S. D. Corey
	C. W. Wright	J. H. Johnston	Maro Johnson	W. B. Hotson
	G. A. Manthey	E. K. Barrett	O. F. Dalstrom	P. N. Nelson

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Where a clean, odorless, paintable treated lumber is required, specify "Wolmanized" brand. Treatment with "Wolman" wood preservative salts introduces no fire hazard. Service records over 25 years prove its effectiveness in protecting against decay and termites.

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	1923-1924	1924-1925	1925-1926	1926-1927
President	J. S. Robinson	J. P. Wood	C. W. Wright	E. T. Howson
1st V.-Pres.	J. P. Wood	C. W. Wright	E. T. Howson	F. C. Baluss
2nd V.-Pres.	C. W. Wright	E. T. Howson	F. C. Baluss	Maro Johnson
3rd V.-Pres.	E. T. Howson	F. C. Baluss	Maro Johnson	J. S. Huntoon
4th V.-Pres.	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise	F. E. Weise	F. E. Weise
Directors	S. T. Corey	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
	W. B. Hotson	A. I. Gauthier	W. B. Hotson	E. L. Sinclair
	P. N. Nelson	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom
	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	W. T. Krausch
	A. I. Gauthier	W. B. Hotson	E. L. Sinclair	R. C. Bardwell
	E. L. Sinclair	P. N. Nelson	O. F. Dalstrom	H. I. Benjamin

	1927-1928	1928-1929	1929-1930	1930-1934
President	F. C. Baluss	Maro Johnson	J. S. Huntoon	C. S. Heritage
1st V.-Pres.	Maro Johnson	J. S. Huntoon	C. S. Heritage	A. I. Gauthier
2nd V.-Pres.	J. S. Huntoon	C. S. Heritage	A. I. Gauthier	H. I. Benjamin
3rd V.-Pres.	C. S. Heritage	A. I. Gauthier	H. I. Benjamin	W. T. Krausch
4th V.-Pres.	A. I. Gauthier	H. I. Benjamin	W. T. Krausch	T. H. Strate
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Asst. Sec.	F. E. Weise	F. E. Weise		
Directors	W. T. Krausch	R. C. Henderson	G. A. Rodman	E. C. Neville
	R. C. Bardwell	J. S. Ekey	W. A. Batey	H. H. Best
	H. I. Benjamin	T. H. Strate	F. W. Hillman	J. E. King
	R. C. Henderson	G. A. Rodman	E. C. Neville	A. B. Scowden
	T. H. Strate	W. A. Batey	H. H. Best	W. A. Batey
	J. S. Ekey	F. W. Hillman	J. E. King	L. C. Smith

	1934-1935	1935-1936	1936-1937	1937-1938
President	H. I. Benjamin	T. H. Strate	E. C. Neville	C. M. Burpee
1st V.-Pres.	T. H. Strate	E. C. Neville	C. M. Burpee	F. H. Masters
2nd V.-Pres.	E. C. Neville	C. M. Burpee	F. H. Masters	W. S. Lacher
3rd V.-Pres.	A. B. Scowden	F. H. Masters	C. A. J. Richards	C. A. J. Richards
4th V.-Pres.	W. R. Roof	C. A. J. Richards	W. S. Lacher	F. H. Cramer
Sec.-Treas.	C. A. Lichty	C. A. Lichty	C. A. Lichty	C. A. Lichty
Directors	C. M. Burpee	A. L. McCloy	W. R. Roof	B. R. Meyers
	W. A. Batey	R. P. Luck	T. P. Soule	G. S. Crites
	L. C. Smith	H. H. Best	F. H. Cramer	R. E. Dove
	C. A. J. Richards	W. R. Roof	B. R. Meyers	T. P. Soule
	A. L. McCloy	T. P. Soule	G. S. Crites	A. Chinn
	R. P. Luck	F. H. Cramer	R. E. Dove	L. G. Byrd

	1938-1939	1939-1940	1940-1941	1941-1942
President	Armstrong Chinn	A.E.Bechtelheimer	H. M. Church	R. E. Dove
1st V.-Pres.	F. H. Cramer	F. H. Cramer	R. E. Dove	F. H. Soothill
2nd V.-Pres.	A.E.Bechtelheimer	H. M. Church	F. A. Soothill	G. S. Crites
3rd V.-Pres.	H. M. Church	R. E. Dove	G. S. Crites	A. M. Knowles
4th V.-Pres.	R. E. Dove	F. H. Soothill	A. M. Knowles	N. D. Howard
Sec.-Treas.	C. A. Lichty	C. A. Lichty		
Secretary	.....	.....	F. O. Whiteman	A. G. Shaver
Treasurer	.....	.....	F. E. Weise	F. E. Welse
Directors	L. G. Byrd	B. R. Meyers	N. D. Howard	R. E. Caudle
	W. R. Ganser	W. Walkden	L. G. Byrd	I. A. Moore
	F. H. Soothill	A. S. Krefting	K. L. Miner	W. A. Sweet
	B. R. Meyers	A. M. Knowles	R. E. Caudle	J. L. Varker
	W. Walkden	L. G. Byrd	I. A. Moore	L. E. Peyser
	A. S. Krefting	K. L. Miner	W. A. Sweet	Martin Meyer

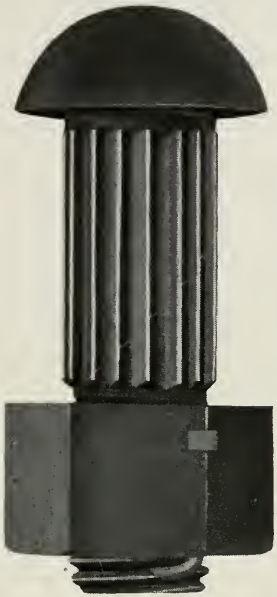
STRUCTURAL RIB BOLTS

Better than rivets

• • • for bridges and trestles

• • • for general steel construction

STRUCTURAL RIB BOLTS offer many advantages over rivets for steel work. When driven into a hole in the work with an ordinary hammer, the triangular ribs deform to make a body-bound fit and lock bolt in position. Only two men with a hammer and wrench are needed to apply; riveting requires three or four men with riveting forge, compressor, and riveting hammer. Fast, stronger, dependable, they assure lower construction costs. Use them with ANCO nuts for permanency.



STRUCTURAL RIB BOLTS, equipped with Anco Lock Nuts, have been approved in place of field-driven rivets for many types of steel erection since 1937, in practically every state and in several foreign countries. They have been approved by the U. S. Treasury Department, Division of Architecture, City Building Code Authorities, and State Highway Department based on the results of many tests, including those of Robert W. Hunt Company and and the University of Wisconsin.

The STRUCTURAL RIB BOLT has

- • • A HIGHER TENSILE VALUE than rivets. It is made from carbon manganese steel, galvanized or black, with a minimum tensile strength of 70,000 lb. per sq. in. as compared to 52,000 to 62,000 lb. per sq. in. for rivets.
- • • A HIGH ALLOWABLE SHEAR VALUE of 22,465 lb. per sq. in.
- • • A HIGH BEARING, S.S. VALUE of 32,000 lb. per sq. in.
- • • A HIGH BEARING, D.S. VALUE of 40,000 lb. per sq. in.

With such values in strength, a fewer number of these bolts than rivets is required for making the same connection. Ideal for bridges, coaling and water stations, sand towers, Diesel shop buildings, and all other steel-framed railroad structures. Why not get complete information and testing samples of the Structural Rib Bolts and Anco Lock Nuts? A word from you on your letterhead does it.

AUTOMATIC NUT COMPANY

LEBANON, PENNSYLVANIA

Warehouse — Chicago, Illinois

For inquiries and samples write to

R. J. Voss, District Manager, 310 S. Michigan Ave., Chicago 4, Ill.

	1942-1943	1943-1944	1944-1945	1945-1946
President.....	G. S. Crites	J. L. Varker	J. L. Varker	N. D. Howard
1st V.-Pres....	R. E. Caudle	R. E. Caudle	R. E. Caudle	F. G. Campbell
2nd V.-Pres....	A. M. Knowles	N. D. Howard	N. D. Howard	J. S. Hancock
3rd V.-Pres....	N. D. Howard	F. G. Campbell	F. G. Campbell	E. H. Barnhart
4th V.-Pres....	J. L. Varker	J. S. Hancock	J. S. Hancock	W. F. Martens
Secretary.....	A. G. Shaver† Lorene Kindred‡ Elinor V. Heffern	Elinor V. Heffern	Elise LaChance	Elise LaChance
Treasurer	F. E. Weise	C. R. Knowles	C. R. Knowles	C. R. Knowles
Treasurer Emeritus		F. E. Weise	F. E. Weise	
Directors	M. Meyer	W. F. Martens	W. F. Martens	A. B. Chapman
	L. E. Peyser	A. L. McCloy	A. L. McCloy	W. A. Huckstep
	K. L. Miner	L. C. Winkelhaus	L. C. Winkelhaus	F. R. Spofford
	F. G. Campbell	E. H. Barnhart	E. H. Barnhart	Guy E. Martin
	J. S. Hancock	A. B. Chapman	A. B. Chapman	B. R. Meyers
	L. C. Winkelhaus	L. E. Peyser	L. E. Peyser	L. E. Peyser

	1946-1947	1947-1948	1948-1949	1949-1950
President....	F. G. Campbell	J. S. Hancock	E. H. Barnhart	W. F. Martens
1st V.-Pres....	J. S. Hancock	E. H. Barnhart	W. F. Martens	W. A. Huckstep
2nd V.-Pres...	E. H. Barnhart	W. F. Martins	W. A. Huckstep	Guy E. Martin
3rd V.-Pres...	W. F. Martens	W. A. Huckstep	Guy E. Martin	F. R. Spofford
4th V.-Pres...	W. A. Huckstep	G. E. Martin	F. R. Spofford	Lee Mayfield
Secretary.....	Elise LaChance	Elise LaChance	Elise LaChance	Elsie LaChance
Treasurer.....	C. R. Knowles	C. R. Knowles*	L. C. Winkelhaus	L. C. Winkelhaus
Directors	Guy E. Martin	H. M. Harlow	Lee Mayfield	H. M. Harlow
	B. R. Meyers	H B. Christianson	F. M. Misch	V. E. Engman
	L. E. Peyser	F. R. Spofford	W. D. Gibson	G. W. Benson
	H. M. Harlow	Lee Mayfield	H. M. Harlow	F. M. Misch
	H. B. Christianson	Franz M. Misch	V. E. Engman	L. R. Morgan
	F. R. Spofford	W. D. Gibson	G. W. Benson	J. A. Jorlett

†To November 1, 1942
‡To February 1, 1943

*Died Aug. 6, 1948

How Many Bridge Decks In This Year's New Rail Program?

DON'T FAIL TO GET BIRD TIE PADS ON EVERY ONE BECAUSE—

1. You get almost as great life extension as on new decks (unless ties are so far gone that redecking will be required very soon).
2. You get your savings much sooner — sometimes in only a few years.
3. You get the same negligible installation costs as with a new deck.
4. You can sometimes salvage and get 5 to 10 additional years out of decks that should otherwise be renewed in two to five years.

Bird Tie Pads have demonstrated their ability to extend life of both new and old ties. Their self-sealing coating preserves sound under-plate and spike hole wood indefinitely.

Bird Tie Pads have always been self-sealing since the first ones made 14 years ago. Until recently they were the only self-sealing pads made. They are still the only ones with years of track use to prove their performance.

BIRD TIE PADS

Bird & Son, inc.

EAST WALPOLE, MASS.

CONSTITUTION

ARTICLE I.

NAME

Section 1. This association shall be known as the American Railway Bridge & Building Association.

ARTICLE II.

OBJECT

Section 1.** The object of this association shall be the advancement of knowledge pertaining to the design, construction and maintenance of railway bridges, buildings, water service facilities, and other structures, by investigation, reports and discussions.

Section 2. The association shall neither indorse nor recommend any particular devices, trade marks or materials, nor will it be responsible for any opinions expressed in papers, reports or discussions unless the same have received the endorsement of the association in regular session.

ARTICLE III.

MEMBERSHIP

Section 1. The membership of this association shall be divided into five classes, viz: Members, life members, associate, honorary and junior members.*

Section 2.** A member shall be a person in a position above rank of gang foreman in connection with railway bridge, building and water service work. Any person desirous of becoming a member shall make application upon the form prescribed by the executive committee, setting forth his name, age, residence and practical experience. He shall furnish at least three references to whom he is personally known. Applicants may be voted into membership at any regular executive meeting or by letter ballot of the executive committee, a majority vote being necessary in either instance.

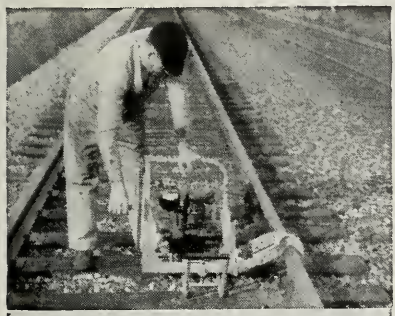
Section 3.** To be eligible for a life membership a member must have belonged to the association for at least twenty years and in general must have retired from active railway service due to age or physical disability. He shall have all the privileges of active membership, except the holding of office, and shall not be required to pay annual dues. The transfer from membership to life membership shall be made in the same manner as the election of members, as prescribed in Section 2, of this Article.

Section 4. Associates shall be responsible persons who are not eligible as members, whose pursuits or attainments qualify them to co-operate with members in the study and development of improved practices in the construction and maintenance of bridges, buildings and water facilities. They shall have all the rights of members except of voting and holding office. They shall be elected in the manner prescribed for members, in Section 2, of this Article.

Section 5. Honorary members shall be chosen from persons who have attained acknowledged eminence in some branch of engineering or railway service. Their number shall be limited to ten. Honorary members shall be proposed by not less than six active members and shall be elected by the unanimous vote of the members present at a regular meeting. They shall have all the rights of active members except that of holding office and shall be exempt from the payment of dues.

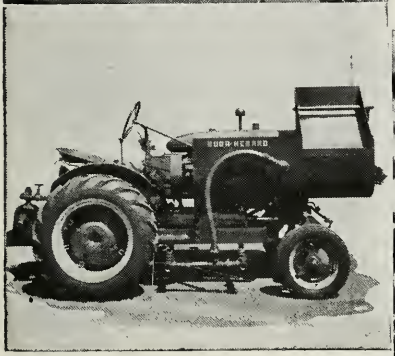
*Amended October 16, 1941.
**Amended September 20, 1948.

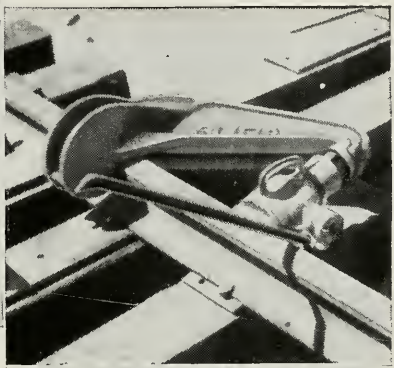
BUDA *serving the railroads since 1881*



• *LEFT:* BUDA Power Track Drill for drilling bolt holes in "T" rail, girder rail or "I" beams, quickly and accurately. Light weight—powerful engine.

• *BELOW:* BUDA Rail Bender, bends heavy cold rail. One man bends 151 lb. rail easily with this handy tool.





• *ABOVE:* We will be glad to discuss the application of the new Buda-Hebard Grouter to your roadbed stabilization problems.

• *RIGHT:* BUDA Klinch-Klaw Jack, ideal for pulling bolts and spikes from bridges and trestles.

WRITE FOR LITERATURE

BUDA

HARVEY *(Chicago Suburb)* **ILLINOIS**

Section 6. A junior member shall be a person who is a graduate of a recognized engineering school, or who has been employed for at least two years in the design, maintenance or construction of railway bridges, buildings or structures. Applicants shall be at least 21 years of age and they shall be elected in the manner prescribed for members, in Section 2 of this article. Juniors shall have all the rights of members except that of holding office. When the attainments of a Junior are such as to qualify him as a member, he may apply for promotion and the Executive Committee shall authorize such promotion when qualifications warrant the action. Unless a Junior is promoted, his membership shall cease automatically when he becomes 28 years of age.*

Section 7. Any member guilty of conduct unbecoming a railroad officer and a member of this association, or who shall refuse to comply with the rules of this association, shall forfeit his membership on a two-thirds vote of the executive committee.

Section 8. Membership shall continue until written resignation is received by the secretary, unless member has been previously expelled, or dropped for non-payment of dues in accordance with Section 1 of Article VII.

Section 9.** Only active members shall hold office in this association, and only active and life members shall be entitled to vote in the election of officers.

ARTICLE IV.

OFFICERS

Section 1. The officers of this association shall be a president, four vice-presidents, a secretary, a treasurer and six directors who with the most recent past president shall constitute the executive committee.

Section 2. The past presidents of this association, previous to the most recent past president, who continue to be members, shall be privileged to attend all meetings of the executive committee, of which meetings they shall receive due notice, and be permitted to discuss all questions and to aid said committee by their advice and counsel; but said past presidents shall not have a right to vote, unless called upon to fill a quorum.

Section 3. Vacancies in any office shall be filled for the unexpired term by the executive committee without delay.

ARTICLE V.

EXECUTIVE COMMITTEE

Section 1.** The executive committee shall manage the affairs of the association and shall have full power to control and regulate all matters not otherwise provided for in the constitution and by-laws and shall exercise general supervision over the financial interests of the association, and make all necessary purchases and contracts required to conduct the general business of the association but shall not have the power to render the association liable for any debt beyond the amount then in the treasury plus accounts receivable and not subject to other prior liabilities. All appropriations for special purposes must be acted upon at a regular meeting of the association.

Section 2. Meetings of the executive committee may be called by a majority of the members of the committee, providing 10 days' notice is given members by mail.

Section 3. Five members of the executive committee shall constitute a quorum for the transaction of business.

ARTICLE VI.

ELECTION OF OFFICERS AND TENURE OF OFFICE

Section 1. Except as otherwise provided the officers shall be elected at the regular annual meeting of the association and the election shall not be postponed except by unanimous consent of the members present at said annual meeting. The election shall be by ballot, a majority of the votes cast being required for election. Any active member of the association not in arrears for dues shall be eligible for office, but the president shall not be eligible for reëlection.

*Amended October 16, 1941.
**Amended September 20, 1948.

96%

ARE
STILL IN SERVICE

We are stating a fact and you don't have to take our word for it. We refer you to one of the most important fact-finding jobs ever undertaken by the water works industry — the recently completed survey of the service life of water works facilities. This survey was sponsored by three water works associations.

The survey shows that 96% of all the cast iron water mains ever laid by 25 representative cities in sizes 6-inch and larger *are still in service.*

A detailed report of the survey has recently been published by the American Water Works Association. We have reprinted, by permission, the facts pertaining to cast iron water mains in a brochure which will be sent on request. Write to Cast Iron Pipe Research Association, Thomas F. Wolfe, Managing Director, 122 South Michigan Ave., Chicago 3, Ill.

CAST IRON PIPE SERVES FOR CENTURIES

Section 2.† The president, four vice-presidents, secretary and treasurer shall hold office for one year and the directors for two years, three directors being elected each year. All officers retain their offices until their successors are elected and installed.

Section 3.† The term of office of the secretary and the treasurer may be terminated at any time by a two-thirds vote of the executive committee. Their compensation shall be fixed by a majority vote of the executive committee.

The secretary shall also serve as secretary of the executive committee.

Section 4. The secretary and the treasurer shall be required to give bond in an amount to be fixed by the executive committee.

ARTICLE VII.

MEMBERSHIP FEE AND DUES

Section 1.† Every member upon joining this association shall pay to the secretary an entrance fee and dues as prescribed by the executive committee. No member in arrears for annual dues shall be entitled to vote at any election and any member more than one year in arrears may be stricken from the list of members at the discretion of the executive committee.

ARTICLE VIII.*

LOCAL SECTIONS

Section 1.** Upon the application of ten or more members of the association residing in the same geographical district, or having offices therein, the executive committee shall organize a local section for that district, to which all members in that district shall be eligible. Such local section shall admit to active membership only members in good standing. It shall hold not less than two meetings each year, and shall be governed by such constitution and by-laws not inconsistent with the constitution of this association as the section membership may adopt and the executive committee of the association approve.

Section 2. The parent association shall not be put under any obligation, either financial or in the matter of policy or opinion, by any local section.

ARTICLE IX.

AMENDMENTS

Section 1. This constitution may be amended at any regular meeting by a two-thirds vote of the members present, provided that notice of the proposed amendment or amendments has been sent to the members at least 30 days previous to said regular meeting.

BY-LAWS

TIME OF MEETING

1.** The regular meeting of this association shall convene annually during the month of September, the exact date to be fixed by the Executive Committee.

PLACE OF MEETING

2.** The place of holding the annual convention shall be Chicago, Ill.

3. It shall lie within the power of the executive committee to change the location or time of the meeting if it becomes apparent that it is for the best interests of the association.

QUORUM

4. At the regular meeting of the association, 15 or more members shall constitute a quorum.

---

†Amended October 17, 1940.
*Article adopted 1922.
**Amended September 20, 1948.

For Long-Time Protection against Corrosion

USE NO-OX-ID

NO-OX-ID Rust Preventives, long a favorite with maintenance men for protection of railway structures, guards metals two ways. Forms a protective film to mechanically seal out moisture and oxygen. Contains chemical inhibitors to prevent underfilm corrosion.

Bridge Protection

The life span of bridges can be lengthened by NO-OX-ID coatings . . . No intensive cleaning is necessary. Signal bridges and turntables can also be given this long-term protection.

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Steel water tanks should be coated inside and out with NO-OX-ID to prevent corrosion. NO-OX-ID is available in suitable consistencies for the job condition.

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NO-OX-ID protects rail joints from corrosion. Also acts as a lubricant to prevent "freezing." Outstanding weathering qualities insure long-term protection.

NO-OX-ID IRON OXIDE RUST

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DEARBORN CHEMICAL COMPANY

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**DUES

5. The annual dues, for the fiscal year ending August 31, and payable in advance, shall be as follows:*

Members, $5.00; Associate Members, $4.00; Junior Members, $2.50.

DUTIES OF OFFICERS

6.† The president shall have general supervision over the affairs of the association. He shall preside at all meetings of the association and of the executive committee; shall appoint all committees not otherwise provided for, and shall be ex-officio member of all committees. He shall with the secretary sign all contracts or other written obligations of the association which have been approved by the executive committee. He shall render a detailed report at least three times during the year to the members of the executive committee, showing the financial condition of the association and its activities.

At the annual meeting the president shall present a report containing a statement of the general conditions of the association.

7. The vice-presidents in order of seniority shall preside at meetings in the absence of the president and discharge his duties in case of a vacancy in his office.

8.† It shall be the duty of the secretary to keep a correct record of the proceedings of all meetings of this association, and of all accounts between this association and its members; to collect all moneys due the association, and deposit the same in the name of the association. He shall pay all bills when properly certified and approved by the president and the treasurer, and make such reports as may be called for by the executive committee. He shall also perform such other duties as the association may require.

9.‡ The treasurer shall have charge of the funds, check all deposits as made by the secretary, sign all checks after they have been approved by the president, and invest all funds not needed for current expenses as directed by the executive committee. He shall report at each annual meeting on the condition of the finances.

NOMINATING COMMITTEE

10. After each annual meeting the president shall appoint a committee of five members, not officers of the association, of whom two at least shall be past presidents, and two of whom shall have served on the committee the previous year, which shall prepare a list of names of nominees for officers to be voted on at the next annual convention, in accordance with Article VI of the constitution, said list to be read at the first session of the second day of said convention. Nothing in this section shall be construed to prevent any member making further nominations.

AUDITING COMMITTEE

11.‡ Prior to each annual meeting the president shall appoint a committee of three members, not officers of the association, whose duty it shall be to examine the accounts and vouchers of the secretary and the treasurer and certify as to the correctness of their accounts.

COMMITTEE ON SUBJECTS FOR DISCUSSION

12. After each annual meeting the president shall appoint a committee whose duty it shall be to prepare a list of subjects for investigation to be submitted for approval at the next convention.

COMMITTEE ON INVESTIGATION

13. After the association has adopted the list of subjects for investigation the president for the succeeding year shall appoint the committees who shall prepare the subjects for report and discussion. He may also appoint individual members to prepare reports on special subjects, or to report on any special or particular subject.

*Amended October 16, 1941.
†Amended October 17, 1940.
‡Adopted October 17, 1940.
**Amended September 20, 1948.

LONG LASTING

Protection...

with GEDCO RESTORATION SERVICE

PAYS DIVIDENDS

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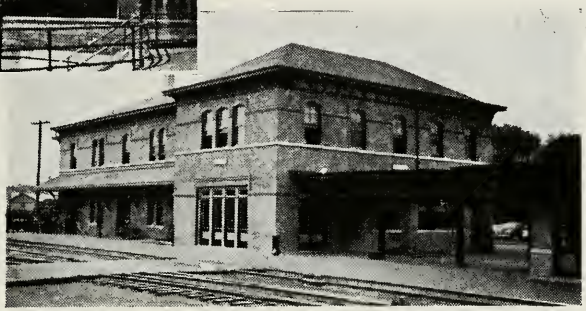

GEDCO'S modern methods of restoration eliminate costly, periodic repainting of masonry buildings and restores the original appearances. Railroad companies are especially pleased with GEDCO restoration and refinishing methods. The photographs (above) show the "before and after" of a building from which paint was removed and the brick work tuck-pointed, then waterproofed. Result—improved appearances and long lasting protection.

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PUBLICATION COMMITTEE

14. After each annual meeting the executive committee shall appoint a publication committee consisting of three active members whose duty it shall be to coöperate with the secretary in the issuing of the publications of the association. The assignment of this committee shall be such that at least one member shall have served on the committee during the previous year.

ORDER OF BUSINESS

15.† Call to order by president.
Opening prayer or invocation.
President's address.
Report of secretary.
Report of treasurer.
Appointment of special committees.
Reports of standing committees and presentation of papers.
Unfinished business.
New business.
Election of officers.
Installation of officers.
Adjournment.

DECISIONS

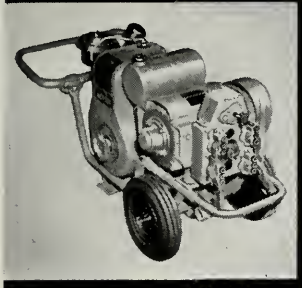
16. The votes of a majority of the members present shall decide any questions, motion or resolution which shall be brought before the association, unless otherwise provided. Unless specifically provided herein otherwise all discussions shall be governed by Robert's rules of order.

AMENDMENTS

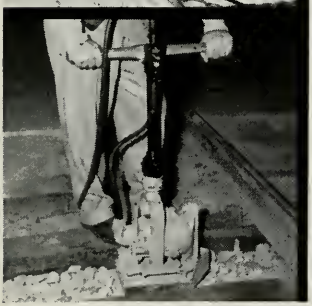
17.† The By-Laws can be amended by a two-thirds vote of those present at any regularly called Executive Committee Meeting.

†Amended September 20, 1948

For MORE SPEED and LOWER COSTS on B&B OPERATIONS!



Model M-2 (2.5 KVA)
Others of 1.25 and 5 KVA



JACKSON PORTABLE POWER PLANTS

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Permanent-magnet Generators

Generators require no maintenance, no adjustment; are absolutely trouble-proof and produce BOTH single-phase and 3-phase 60 cycle AC to full rated capacity. Powered by husky Wisconsin gas engines. Proved outstandingly reliable throughout the railway and construction fields. Ideal for operating vibrators, power tools and lights. Will give uninterrupted service day in and day out.

JACKSON VIBRATORY SOIL COMPACTOR

Unequaled for fast and thorough compaction of granular soils in areas adjacent to BRIDGES, CULVERTS, STRUCTURES; in SUB-FLOORS, TRENCHES and many other places inaccessible to rollers. Achieves up to 95% of maximum density in a SINGLE PASS. Firmly compacts 15 to 18 sq. ft. per minute to a depth of 12". Easily portable. Time-tested motor — 3-phase 110 volt, 60 cycle AC. Jackson 1.25 KVA Power Plant will operate two of these machines simultaneously.

JACKSON VIBRATORY ASPHALT COMPACTORS

Two models, of which the smaller is illustrated, ideal for compacting asphalt at station platforms, grade crossings and all other applications likely to be encountered in B&B operations. 3-phase 110 volt, 60 cycle AC from Jackson Portable Power Plants or commercial source.

JACKSON ELECTRIC VIBRATORY SCREED

Perfect for concrete paving, patching, bridge decks, etc. Undercuts at sideforms, works right around manholes and other obstructions. Strikes off crowns, regular or inverted. Powered by Jackson Portable Power Plant.

VIBRATORS FOR ALL TYPES OF CONCRETE CONSTRUCTION

ELECTRIC TAMPER & EQUIPMENT CO., LUDINGTON MICHIGAN

DIRECTORY OF MEMBERS

as of April 30, 1951

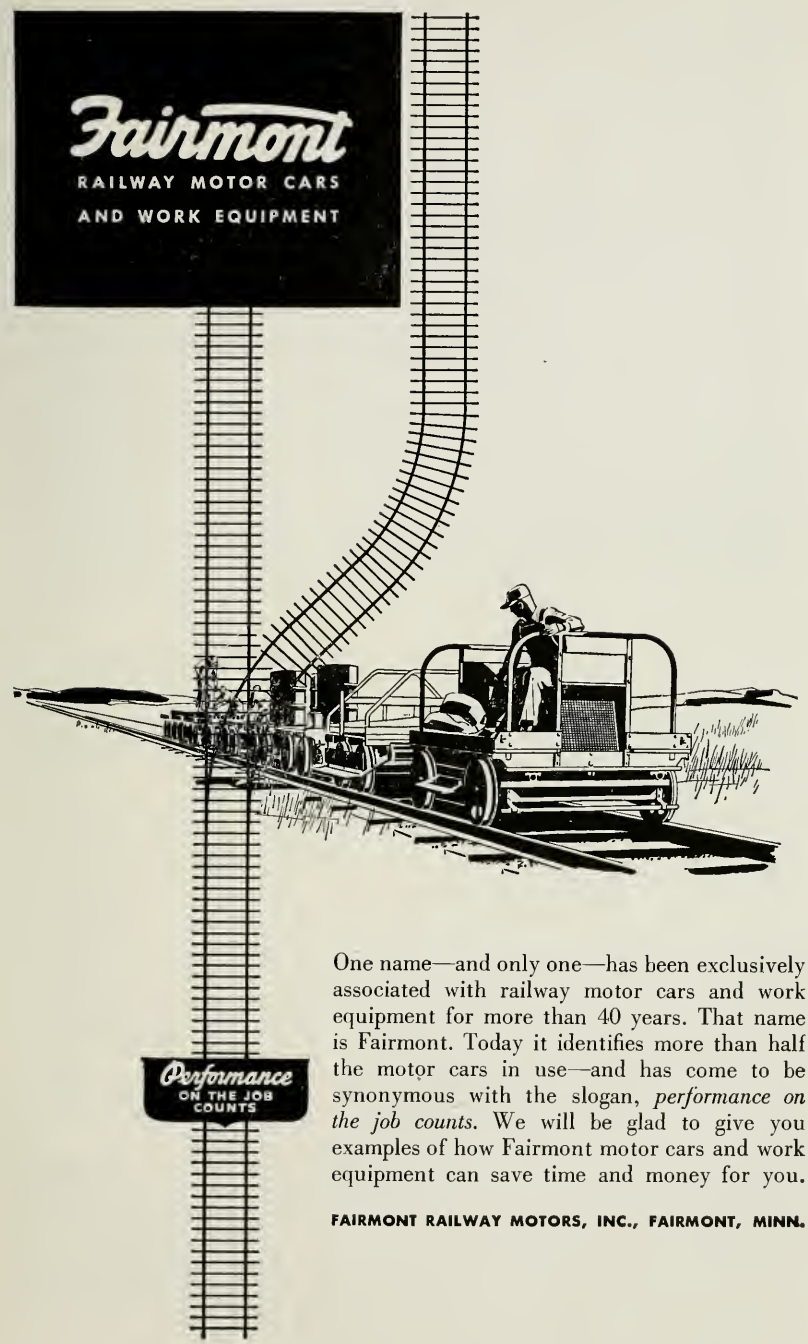
(Figure after each name indicates year when member joined association.)

ACTIVE MEMBERS

H. C. Aaron, Supv. B. & B., W. M. R. R., Hagerstown, Md., (1935).
A. F. Ainslie, Supv. B. & B., N. P. Ry., Spokane, Wash., (1948).
J. L. Alvord, Dist. Per. Off., C. & O. Ry., Saginaw, Mich., (1950).
A. Anderson, Sp. Asst. Engr., N. Y. C. R. R., Chicago, (1947).
J. L. Anderson, Sup. B. & B., Mo. Pac. R. R., Osawatomie, Kans., (1931).
J. T. Andrews, Spec. Engr., B. & O. R. R., Baltimore, Md., (1947).
W. F. Armstrong, Arch. Dftsmn., C. & N. W. Ry., Chicago, (1947).
T. J. Atkinson, Mast. Carp., Penn. R. R., Pittsburgh, Pa., (1947).
S. K. Autrey, B. & B. & W. S. Insp., Burlington-Rock Isand, Teague, Tex.

J. H. Babbitt, Asst. Div. Eng., B. & O. R. R., Indianapolis, Ind., (1946).
B. Baker, Asst. Sup. B. & B., C. & O. Ry., Saginaw, Mich. (1950).
R. C. Baker, B. & B. Supv., C. & E. I. Ry., Danville, Ill., (1940).
E. C. Baling, B. & B. Supv., N. & S. Ry., Cary, N. C., (1950).
E. H. Barnhart, Div. Engr., B. & O. R. R., Garrett, Ind., (1941).
H. L. Barr, Div. Engr., C. & N. W. Ry., Boone, Ia., (1938).
S. J. Barranco, Asst. Mast. Carp., Penn. R. R., Pittsburgh, Pa., (1951).
G. J. Bass, Gen. For., B. B. & W. S., G. C. & S. F. Ry., Galveston, Tex., (1946).
Y. C. Beam, Asst. Mast. Carp., S. A. L. Ry., Americus, Ga., (1945).
J. F. Beaver, Chf. Eng., So. Ry., Charlotte, N. C., (1950).
W. H. Begeman, B. & B. Supvr., Mo. Pac. R. R., Jefferson City, Mo., (1941).
J. C. Begley, Div. Engr., B. & O. R. R., Washington, Ind., (1946).
H. I. Benjamin, Vice-Chair. Sys., Com. on Ins., So. Pac. Ry., San Francisco, Cal., (1922).
G. W. Benson, Supt. Bridges, C. of G. Ry., Macon, Ga., (1940).
J. A. Bergeron, Asst. B. & B. Master, C. N. R., Parent, Que., (1949).
M. A. Beringer, Br. Insp., I. C. R. R., Chicago, (1929).
C. E. Bingaman, Mast. Carp., Reading Co., Tamaqua, Pa., (1948).
H. F. Bird, Supv. B. & B., N. Y. C. Sys., Syracuse, N. Y., (1937).
R. D. Bisbee, Div. Engr., P. & S. F. Ry., (A. T. & S. F.) Slaton, Tex., (1947).
O. H. Blankenship, W. S. For., M. P. R. R., Poplar Bluff, Mo., (1948).
E. H. Blewer, Asst. Supt. Safety, N. Y. C. Sys., New York, (1937).
J. J. Bliss, Gen. B. & B. For., Belt Ry. of Chgo., Chicago, Ill., (1950).
M. Block, Engr. of Bridges, I. C. R. R., Chicago, (1948).
H. Bober, B. & B. Engr., G. M. & O. R. R., Mobile, Ala., (1947).
H. A. Boehling, Jr., Asst. Cost Engr., C. & O. Ry., Richmond, Va., (1948).
W. C. Borchert, Div. Engr., K. C. S., Shreveport, La., (1942).
M. A. Bost, Asst. Engr., C. M. St. P. & P. R. R., Mason City, Iowa, (1935).
J. J. Brandimarte, Jr., Mast. Carp., Penn. R. R., Cleveland, Ohio, (1947).
I. C. Brewer, Div. Engr., C. M. St. P. & P. R. R., Milwaukee, Wis., (1947).
W. T. Brice, B. & B. Master, C. N. R., Regina, Sask., Can., (1946).
E. C. Bridjette, Sr. Asst. B. & B. Supv., So. Pac. Co., Los Angeles, Cal., (1950).
E. J. Brown, Engr. of Track, C. B. & Q. R. R., Chicago, (1947).
T. W. Brown, Chf. Water Chem., I. C. R. R., Chicago, (1947).
C. O. Bryant, Div. Engr., C. R. I. & P., Kansas City, Mo., (1950).
F. N. Budzenski, Asst. Supv. B. & B., C. & N. W. Ry., Antigo, Wis., (1938).
W. H. Bunge, Asst. Engr., M. P. Lines, Houston, Tex., (1941).
E. E. Burch, Br. Engr., C. M. St. P. & P. Rv., Chicago, (1945).
A. E. Burford, Gen. For. B. & B., I. C. R. R., Memphis, Tenn., (1947).
W. R. Burke, B. & B. Supv., I. C. R. R., Champaign, Ill., (1947).
C. H. Burks, Div. Engr., S. A. L. Ry., Jacksonville, Fla., (1951).
C. M. Burpee, V.-P. Sls. Pro., Simmons-Boardman Pub. Corp., New York, (1930).
C. D. Burrows, Mast. Carp., B. & O. R. R., Wilmington, Del., (1946).
G. Burrows, Asst. B. & B. Supv., M. P. R. R., St. Louis, Mo., (1950).

W. W. Caines, Supv. B. & B., C. & O. Ry., Huntington, W. Va., (1938).
F. G. Campbell, Ch. Engr., E. J. & E. Ry., Joliet, Ill., (1936).
M. D. Carothers, Asst. Chf. Engr., G. M. & O. R. R., Bloomington, Ill., (1938).
J. W. Carter, B. & B. Supv., Vir. Ry. Co., Roanoke, Va., (1947).
R. W. Cassidy, Supv. B. & B., C. & O. Ry., Peru, Ind., (1949).
R. E. Caudle, Asst. Engr. Str., M. P. Lines, Houston, Tex., (1921).
T. M. Cawthon, Asst. B. & B. Supv., S. P. Co., Martinez, Cal., (1943).
P. C. Chamberlain, Asst. Engr., Erie R. R., Cleveland, Ohio, (1941).
A. B. Chaney, Asst. Chief Engr. M. W., Mo. Pac. Lines, St. Louis, Mo., (1947).
S. L. Chapin, Saf. Supv., So. Pac. Co., San Francisco, Cal., (1946).
A. B. Chapman, Asst. Engr., C. M. St. P. & P. R. R., Chicago, (1938).
A. Chinn, Pres., Term. R. R. Assoc. of St. L., St. Louis, Mo., (1930).
H. B. Christianson, Asst. Chf. Engr., C. M. St. P. & P. Rv., Chicago, (1928).
C. M. Chumley, Engr. M. of W., I. C. R. R., Chicago, (1947).
L. Clapper, Ch. Engr., D. M. & I. R. Ry., Duluth, Minn., (1919).
K. L. Clark, Prin. Asst. Engr., C. M. St. P. & P. R. R., Chicago, (1939).
W. P. Clark, Supv. B. & B., L. V. R. R., Wilkes-Barre, Pa., (1944).
E. J. Clonton, Div. Engr., B. & O. R. R., Cumberland, Md., (1944).
G. W. Cobb, Asst. B. & B. Supv., So. Pac. Co., Sparks, Nev., (1948).
G. Cole, B. & B. Gen. For., A. T. & S. F. Ry., Emporia, Kan., (1949).
E. L. Collette, Sr., Div. Engr., St. L.-S. F., Fort Smith, Ark., (1949).



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P. B. Collier, Supt. Scales, M. P. R. R., St. Louis, Mo., (1938).
R. L. Collum, Mast. Carp., S. A. L. Ry., Jacksonville, Fla., (1941).
A. A. Colvin, Div. Engr., C. & N. W. Ry., Norfolk, Nebr., (1937).
D. W. Converse, Br. Engr., A. C. & Y. R. R., Akron, Ohio, (1940).
E. F. Cook, Water Serv. For., Mo. Pac. R. R., Little Rock, Ark., (1947).
A. W. Cooper, Eng. Insp., S. A. L. Ry., Savannah, Ga., (1951).
A. E. Copeland, Mast. Carp., C. B. & Q. R. R., LaCrosse, Wis., (1947).
R. F. Copeland, Mast. Carp., C. B. & Q. R. R., Creston, Iowa, (1950).
F. J. Corporon, Supt. W. & S., C. S. S. & S. B., Michigan City, Ind., (1950).
L. A. Cowsert, W. Insp., B. & O. R. R., Dayton, Ohio, (1915).
R. C. Cox, B. & B. Supv., W. P. R. R., Sacramento, Cal., (1950).
F. H. Cramer, Br. Engr., C. B. & Q. R. R., Chicago, (1927).
F. W. Creedle, Asst. Engr. of Mtce., C. & N. W. Ry., Chicago, (1942).
C. H. Crews, B. & B. Supv., I. C. R. R., Jackson, Tenn., (1947).
P. H. Croft, Asst. Engr. M. W., I. C. R. R., Memphis, Tenn., (1947).
W. E. Crounse, Supv. B. & B., D. & H. R. R., Carbondale, Pa., (1945).
A. W. Cruikshank, Gen. Plm. For., D. & H. R. R., Green Island, N. Y., (1950).
J. W. Cummings, Supv. Wk. Eqpt., D. & H. R. R., Albany, N. Y., (1947).
C. P. Cummins, Asst. Engr., M. K. T. R. R., St. Louis, Mo., (1948).
H. D. Curie, Mast. Carp., B. & O. R. R., Garrett, Ind., (1942).

P. E. Dale, Supv. B. & B., N. Y. C. Sys., Indianapolis, Ind., (1947).
G. B. Davis, B. & B. Supv., N. Y. C. Sys., Columbus, Ohio, (1942).
H. E. Davis, B. & B. Supv., N. Y. C. Sys., Chicago, (1940).
L. H. Davis, Gen. For. B. & B., A. T. & S. F. R. R., Amarillo, Tex., (1948).
F. D. Day, Mast. Carp., Penn. R. R., Pittsburgh, Pa., (1949).
R. DeArmond, Asst. B. & B. Supv., So. Pac. Co., San Francisco, Cal., (1938).
R. T. Dedow, Dftman., N. Y. C. Sys., Detroit, Mich., (1950).
H. R. Demmon, Asst. Gen. B. & B. Insp., So. Pac. Co., Albany, Cal., (1948).
A. H. Deno, Supv. B. & B., C. & N. W. Ry., Green Bay, Wis., (1941).
L. J. Deno, Div. Eng., C. & N. W. Ry., Escanaba, Mich., (1947).
A. R. De Walt, Mast. Carp., Penn. R. R., Cleveland, O., (1949).
H. M. Dick, Mast. Carp., Penn. R. R., Harrisburg, Pa., (1942).
M. H. Dick, Ed., Ry. Engr. & Mtce., Chicago, (1937).
N. Dixon, B. & B. Mast., C. N. R., Montreal, Que., (1949).
Fred Dodson, Asst. Supv. B. & B., C. & O. R. R., Covington, Ky., (1948).
A. G. Dorland, Asst. Engr., E. J. & E. Ry., Joliet, Ill., (1941).
J. L. Dougherty, Supv. B. & B., W. M. Ry., Cumberland, Md., (1944).
R. E. Dove, Man. Ed., Ry. Engr. & Mtce. Cycl., Chicago, (1934).
C. R. DuBose, Res. Engr., Mo. Pac. R. R., Houston, Tex., (1948).
J. V. Duehac, Supv. B. & B., C. & N. W. Ry., Antigo, Wis., (1927).
A. E. Dulik, Gen. For. B. & B., Penn. R. R., Harrisburg, Pa., (1950).
J. P. Dunnagan, Engr. of Br., So. Pac. Co., San Francisco, Cal., (1943).
F. Duresky, Jr., Supv. B. & B., C. & N. W. Ry., Huron, So. Dak., (1942).
W. E. Dwy, Field Engr., B. & O. R. R., Pittsburgh, Pa., (1948).

J. Ebbens, Supv. B. & B., C. & W. I. R. R., Chicago, (1947).
O. F. Edlund, Sup. W. S. Eqpt., Belt Ry. of Chgo., Chicago, (1950).
C. M. Eichenlaub, Res. Engr., S. D. & A. E. Ry. Co., San Diego, Cal., (1943).
C. Eisele, Asst. Engr., N. Y. C. Sys., Chicago, (1930).
C. E. Elliott, Div. Engr., W. P. R. R., Sacramento, Cal., (1950).
L. Elower, Traveling Br. Insp., Erie R. R., Owego, N. Y., (1948).
E. M. Enger, Supr. B. & B., C. St. P. M. & O. Ry., St. Paul, Minn., (1947).
N. V. Engman, Assoc. Edtr., Ry. Engr. & Mtce., Chicago, (1949).
V. E. Engman, Ch. Carp., C. M. St. P. & P. R. R., Savanna, Ill., (1920).
J. M. Erickson, B. & B. Supv., Wab. R. R., Montpelier, Ohio, (1950).
O. Erickson, Asst. B. & B. Supv., So. Pac. Co., Sacramento, Cal., (1950).
F. A. Ernst, Div..Engr., B. & O. R. R., Pittsburgh, Pa., (1948).
H. E. Ezzell, Asst. Scale Supv., Mo. Pac. Lines, San Antonio, Tex., (1947).

C. Fest, c/o B. & B. Supv., So. Pac. Co., Portland, Ore., (1948).
S. F. Fiducia, Architect, N. Y. C. Sys., Detroit, Mich., (1950).
L. M. Firehammer, Gen. Supv. B. & B., Ill. Term. R. R., Springfield, Ill., (1919).
G. R. Fisher. B. & B. Master, Ca. Nat. R. R., Stratford, Ont., Canada, (1948).
A. N. Ford, Supv. B. & B., A. C. L. R. R., Savannah, Ga., (1950).
C. E. Forseth, Div. Eng., W. P. R. R., Elko, Nev., (1950).
E. E. Foster, Asst. Engr., M. St. P. & S. S. M. R. R., Stevens Point, Wis., (1947).
K. Fouts, Gen. For. B. & B. & W. S., St. L.-S. F. R. R., Chaffee, Mo., (1948).
R. L. Fox, Div. Engr., So. Ry., Alexandria, Va., (1935).
C. G. Frietz, Supv. B. & B., C. & N. W. Ry., Escanaba, Mich., (1938).
H. C. Fronaberger, B. & B. Supv., T. & P. Ry., Fort Worth, Tex., (1949).
L. M. Frost, Supv. B. & B., G. T. W. Ry., Battle Creek, Mich., (1938).
W. E. Fuhr, Div. Engr., C. M. St. P. & P. R. R., Miles City, Mont., (1948).
B. J. Furniss, B. & B. Supv., N. Y. N. H. & H. R. R., Hartford, Conn., (1946).

C. W. Gabrio, Br. Engr., Virginian Ry., Norfolk, Va., (1947).
J. Galbraith, B. & B. Supv., N. Y. C. R. R., New York, N. Y., (1947).
F. E. Galvin, Chief Carp., C. M. St. P. & P. R. R., La Crosse, Wis., (1948).
J. P. Gannon, Div. Engr., M. St. P. & S. S. M. Ry., Stevens Point, Wis., (1947).
J. W. Gannon, Jr., Supv. B. & B., B. & M. R. R., Concord, N. H., (1948).
C. E. Garcelon, Supt. B. & B., B. & A. R. R., Houlton, Me., (1945).
L. D. Garis, Gen. Br. Inspr., C. & N. W. Ry., Chicago, (1930).
G. W. Gearhart, Asst. Sup. B. & B., N. & W. Ry., Roanoke, Va., (1950).
C. J. Geyer, Asst. Vice-Pres., C. & O. Ry., Richmond, Va., (1928).
W. D. Gibson, W. S. Engr., C. B. & Q. R. R., Chicago, (1946).
L. C. Gilbert, Sr. Engr., E. J. & E. Ry., Joliet, Ill., (1950).
J. M. Giles, Asst. Engr. Rdway. Machines, M. P. R. R., St. Louis, Mo., (1938).
W. G. Gillespie, Mast. Carp., B. & O. R. R., Grafton, W. Va., (1946).

For rugged railroad demands, Insulux resists smoke, rust, rot; seldom needs washing; insulates like an 8-inch brick wall. Service Depot designed by De-Leuw Cather & Co., Architect: Chief Engineer E. C. Vanderburgh, Consulting Architect: A. N. Rebori.

DAYLIGHT IS FREE—DON'T ABUSE IT— USE IT—THROUGH Daylight Engineering

Why install windows to let daylight in, then cover most of the openings with blinds, shades or curtains to keep out the glare?

That is a wasteful, old-fashioned way of handling free light.

Now Daylight Engineering with an Insulux Fenestration System shows you how to use daylight most effectively . . . lets you provide light through a tough, durable product that never rusts or rots, is highly fire-resistant.

Want more information on how to let more daylight into dark places? Write our Daylight Engineering Laboratory, Dept. B. B. 50, Box 1035, Toledo 1, Ohio. Insulux Division, American Structural Products Company, subsidiary of Owens-Illinois Glass Company.

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INSULUX FENESTRATION SYSTEMS

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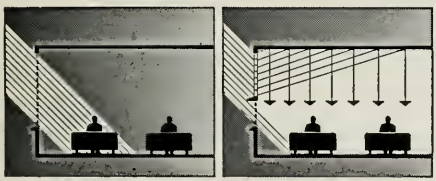

Direct sun causes uncomfortable brightness near windows, extreme contrast in other parts of room. Insulux Fenestration (glass block plus vision strip) directs and spreads daylight to ceiling, keeps brightness at comfortable levels, provides vision and ventilation.

R. W. Gilmore, Gen. Br. Insp., B. & O. R. R., Cincinnati, Ohio, (1943).
F. E. Gladwin, B. & B. Supv., No. Pac. R. R., San Rafael, Cal., (1950).
A. M. Glander, Ch. Carp., C. M. St. P. & P. Ry., Mason City, Iowa, (1936).
E. U. Gogl, Prin. Asst. B. & B. Supv., So. Pac. Co., Hillsboro, Ore., (1948).
J. R. Goodman, Trk. Supv., So. Ry., Keysville, Va., (1951).
J. L. Gorrie, Asst. B. & B. Supv., So. Pac. Co., Eugene, Ore., (1948).
H. E. Graham, Asst. Supt. W. S., I. C. R. R., Chicago, (1946).
W. R. Graham, Asst. Supv. B. & B., C. & O. R. R., Erlanger, Ky., (1946).
H. P. Greene, Mast. Carp., Penn. R. R., Columbus, Ohio, (1947).
A. Guenther, Asst. Mast. Carp., C. B. & Q. R. R., Galesburg, Ill., (1947).
R. B. Gunderson, Asst. Br. Engr., So. Ry. Co., Washington, D. C., (1947).
J. M. Gustafson, Br. Engr., Minn. & St. Louis Ry., Minneapolis, Minn., (1948).

E. H. Haase, c/o B. & B. Supv., So. Pac. Co., Oakland, Cal., (1943).
C. A. Hackett, Asst. B. & B. Supv., So. Pac. Co., El Paso, Tex., (1948).
C. E. Hagenmaier, Asst. B. & B. Supv., So. Pac. Co., San Francisco, Cal., (1950).
S. H. Hailey, Sr. Asst. Engr., N. C. & St. L. Ry., Nashville, Tenn., (1948).
P. D. Haines, B. & B. Supv., C. & O. Ry., Saginaw, Mich., (1943).
H. C. Halliday, B. & B. Master, Can. Nat'l Ry., Prince Rupert, B. C., Can., (1947).
A. Hamill, B.&B. Master, Esquimalt & Nanaimo Ry., Victoria, B.C., Can., (1948).
C. W. Hamilton, Eng. Des., Wabash R. R., St. Louis, Mo., (1950).
A. A. Hampton, Asst. Supv. B. & B., Mo. Pac. Lines, De Quincy, La., (1947).
J. S. Hancock, Br. Engr., D. T. & I. R. R., Dearborn, Mich., (1916).
J. A. Hanson, B. & B. Supv., N. Y. C. Sys., Cincinnati, Ohio, (1947).
***R. J. Hardenbergh,** Draftsman, N. Y. C. Sys., Detroit, Mich., (1949).
C. R. Harding, Pres., The Pullman Co., Chicago (1924).
H. M. Harlow, Asst. Gen. Supv. B. & B., C. & O. Ry., Richmond, Va., (1939).
W. C. Harman, Supv. B. & B., So. Pac. Co., San Francisco, Cal., (1911).
M. J. Harp, Supv. B. & B., Mo. Pac. R. R., Poplar Bluff, Mo., (1938).
A. R. Harris, Engr. of Bridges, C. & N. W. Ry., Chicago, (1940).
L. M. Hartley, Mast. Carp., S. A. L. R. R., Tampa, Fla., (1948).
G. F. Hartman, Asst. Supv. B. & B., C. & O. Ry., Columbus, Ohio, (1947).
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C. L. Hawkins, Asst. Mast. Carp., Penn. R. R., Pittsburgh, Pa., (1950).
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J. E. Heck, Supv. B. & B., C. & O. Ry., Ashland, Ky., (1938).
R. L. Hecker, B. & B. Supv., C. & O. Ry., Grand Ledge, Mich., (1947).
W. J. Hedley, Asst. Chf. Eng., Wabash R. R., St. Louis, Mo., (1950).
R. D. Hellweg, Asst. Div. Engr., G. M. & O. Ry., Bloomington, Ill., (1947).
B. Hemstad, Mast. Carp., Gr. Nor. Ry., Willmar, Minn., (1937).
H. R. Herrick, Sr. Asst. B. & B. Supv., So. Pac. Co., El Paso, Tex., (1950).
R. F. Hill, Supv. B. & B., C. I. & L. Ry., Crawfordsville, Ind., (1935).
A. B. Hillman, Asst. Chf. Eng., C. & W. I.-Belt Ry. of Chicago, (1942).
J. T. Hiner, B. & B. Supv., So. Ry., Greenville, S. C., (1950).
P. W. Hofstetter, Asst. B. & B. Supr., M. P. R. R., San Antonio, Tex., (1946).
V. V. Holmberg, Engr. M. of W., C. & W. I. Ry. and Belt Ry. of Chgo., Chicago, (1942).
J. L. Holmes, B. & B. Supr., N. Y. N. H. & H., New Haven, Conn., (1949).
F. F. Hornig, Div. Engr., C. M. St. P. & P. R. R., Mason City, Iowa, (1947).
K. E. Hornung, Arch., C. M. St. P. & P. R. R., Chicago, (1949).
N. D. Howard, Secretary, A. R. E. A., Chicago, (1926).
W. A. Howard, Asst. B. & B. Supv., T. & N. O. R. R., Ennis, Tex., (1950).
B. J. Howay, Supv. B. & B. W. S., C. & O. Ry., Grand Ledge, Mich., (1919).
A. C. Hoyt, B. & B. Engr., E. J. & E. R. R., Joliet, Ill., (1947).
M. J. Hubbard, Gen. Supv. B. & B., C. & O. Ry., Richmond, Va., (1948).
V. T. Huckaby, Steel Br. Insp., M. K. T. R. R. Co., Hillsboro, Tex., (1947).
W. A. Huckstep, Gen. Supv., M. P. R. R., St. Louis, Mo., (1941).
N. E. Hueni, Asst. Engr., M. P. R. R., Houston, Tex., (1949).
W. H. Huffman, Div. Engr., C. & N. W. Ry., Chicago, (1941).
F. G. Hull, B. & B. Supv., C. & O. Ry., St. Thomas, Ont., Can., (1947).
R. W. Humphreys, Div. Engr., Nor. Pac. Ry., Missoula, Mont., (1947).
F. C. Huntsman, Div. Engr., Wab. R. R., St. Louis, Mo., (1922).
P. F. Huston, Mast. Carp., Colo. & So., Denver, Colo., (1948).
F. W. Hutcheson, Asst. Supv. B. & B., C. & O. Ry., Newport News, Va., (1938).
W. A. Hutcheson, Supv. Wk. Eqpt., C. & O. Ry., Clifton Forge, Va., (1939).
V. W. Hutchings, B. & B. Supv., S. P. Co., Bakersfield, Cal., (1941).
D. G. Hutchinson, B. & B. Insp., W. P. R. R., Elko, Nev., (1950).
J. E. Hutto, Res. Eng., S. A. L. Ry., Savannah, Ga., (1951).

J. V. Ivabinet, Gen. Br. Insp., S. A. L. R. R., Norfolk, Va., (1948).
H. W. Ingram, Field Engr., B. & O. R. R., Pittsburgh, Pa., (1949).
J. A. Inmann, Gen. For. B. & B., St. L.-S. F. Ry., Chaffee, Mo., (1947).

H. E. Jackman, Mast. Carp., B. & O. R. R., Chillicothe, Ohio, (1944).
T. E. Jackson, Gen. B. & B. Supv., So. Pac. Co., San Francisco, Cal., (1948).
W. R. Jacobson, Asst. Engr., M. St. P. & S. S. M. R. R., Stevens Point, Wis., (1948).
M. Jarratt, W. & F. Supr., S. P., Tucson, Ariz., (1950).
D. H. Jenkins, B. & B. Supv., St. L.-S. W. Ry., Pine Bluff, Ark., (1950).
H. W. Jenkins, Asst. Div. Engr., N. Y. N. H. & H. R. R., Boston, Mass., (1940).
A. C. Johnson, Engineer of Design, E. J. & E. Ry., Joliet, Ill., (1944).
A. J. Johnson, Acte. Mast. Carp., B. & O. R. R., Garrett, Ind., (1950).
B. O. Johnson, Asst. Engr., C. M. St. P. & P. R. R., Chicago, (1931).
D. H. Johnson, Supv. B. & B., C. St. P. M. & O. Ry., Altoona, Wis., (1940).
H. G. Johnson, Asst. Engr., C. M. St. P. & P. R. R., Ottumwa, Ia., (1930).
H. T. Johnson, Asst. Mast. Carp., Penn. R. R., Wilmington, Del., (1949).
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G. H. Johnston, Gen. For. B. & B., A. T. & S. F. Ry., Marceline, Mo., (1950).
H. W. Johnston, Gen. Br. Dftmn., S. A. L. Ry., Norfolk, Va., (1950).
A. C. Jones, Supv. B. & B., So. Ry., Birmingham, Ala., (1938).
E. B. Jones, Br. Insp., C. & O. Ry., Clifton Forge, Va., (1945).
J. A. Jorlett, Asst. Engr., Penna. R. R., New York, N. Y., (1946).

W. P. Karwich, Trav. B .& B. Insp., Erie R. R., Wadsworth, Ohio, (1948).
F. A. Kelly, B. & B. Supv., N. Y. N. H. & H., Providence, R. I., (1949).
R. A. Kelso, B. & B. Supv., So. Ry., Valdosta, Ga., (1949).
W. G. Kemmerer, Asst. Engr. B. & B., Penna. R. R., New York, (1931).
J. T. Kendall, Sp. Duty for Penn. R. R., Terre Haute, Ind., (1949).
G. M. Ketchie, Jr., Asst. Engr. Bldgs., So. Ry., Charlotte, N. C., (1948).
L. P. Kimball, Eng. Bldg., B. & O. R. R., Baltimore, Md., (1921).
D. P. Kinzel, Supv. B. & B., N. Y. C. R. R., Delmar, N. Y., (1948).
P. L. Koehler, Asst. Supt., C. & O. Ry., Peach Creek, W. Va., (1938).
W. B. Konkle, For. Carp., Reading Co., Milton, Pa., (1947).
A. S. Krefting, Prin. Asst. Eng., M. St. P. & S. S. M. Ry., Minneapolis, Minn., (1935).
H. H. Kruse, Ch. Carp., C. M. St. P. & P. R. R., Mitchell, So. Dak., (1947).
S. E. Kvenberg, Asst. Engr., C. M. St. P. & P. R. R., Chicago, (1932).

J. J. LaBat, B. & B. Supv., Mo. Pac. Ry., Wichita, Kans., (1937).
C. W. Laird, Scale Supt., Mo. Pac. Lines, Houston, Tex., (1947).
L. R. Lamport, Engr. of Mtce., C. & N. W. System, Chicago, (1935).
W. Lampson, Supv. B. & B., Maine Cent. R. R., Portland, Me., (1930).
***R. J. Landregan,** Asst. on Engr. Corps, C. & E. I. Ry., Danville, Illinois, (1950).
W. A. Langford, Asst. Supv. B. & B., Mo. Pac. R. R., Monroe, La., (1948).
K. Larson, Supv. B. & B., C. & N. W. Ry., Sioux City, Iowa, (1947).
W. T. League, Mast. Carp., Penn. R. R., Pittsburgh, Pa., (1949).
V. L. Lenk, Gen. For. B. & B. & W. S., St. L.-S. F., Tulsa, Okla., (1948).
***C. C. Lederer,** Insp., N. Y. C. Sys., Detroit, Mich., (1949).
F. L. Lee, Mast. Carp., Penn. R. R., Cincinnati, Ohio, (1951).
J. R. Leguenec, Supv. B. & B., St. L.-S. W. Ry., Tyler, Tex., (1948).
H. G. Lehman, Asst. B. & B. Supv., So. Pac. Co., Tucson, Ariz., (1950).
F. J. A. Leinweber, B. & B. Mast., Can. Nat'l Rys., St. Thomas, Ont., Can., (1947).
R. L. Lewis, Supv. B. & B., B. A. & Pac. Ry., Anaconda, Mont., (1948).
G. A. Linn, Div. Engr., C. & N. W. Ry., Chadron, Nebr., (1940).
C. A. Little, Asst. Supv. B. & B., B. & M. R. R., Concord, N. H., (1918).
H. C. Little, Supv. W. S., I. C. R. R., Vicksburg, Miss., (1948).
G. P. Lokotzke, Supv. B. & B., E. J. & E. Ry., Gary, Ind., (1947).
R. J. Lorber, Supv. B. & B., P. & P. U. Ry., Peoria, Ill., (1948).
H. T. Lord, B. & B. Master, Can. Pac. Ry., Kenora, Ont., (1940).
H. B. Lorence, Fire Prot. Engr., C. R. & I. (N. Y. C.), (Gibson), Hammond, Ind., (1950).
J. M. Lowry, Br. Eng. & Insp., T. & N. O. R. R., Houston, Tex., (1950).
R. P. Luck, Dftsman., C. & N. W. Ry., Chicago, (1920).
C. V. Lund, Asst. Eng., C. M. St. P. & P. R. R., Chicago, (1947).
L. E. Lyon, Div. Engr., So. Pac. Co., El Paso, Tex., (1947).

M. L. McCauley, Asst. Eng. of Str., N. Y. C. Sys., Elmhurst, Ill., (1950).
J. F. McCay, B. & B. Insp., N. Y. C. Sys., Chicago, (1945).
A. A. McDermott, B. & B. Supv., So. Pac. Co., Dunsmuir, Cal., (1945).
J. W. McDonald, Gen. For. B. & B. W. S., St. L.-S. F. Ry., Springfield, Mo., (1947).
C. S. McElreath, B. & B. Supv., So. Ry., Atlanta, Ga., (1951).
F. O. McGrew, Ch. Carp., C. M. St. P. & P. R. R., Terre Haute, Ind., (1948).
E. R. McKee, Asst. Div. Engr., B. & O. R. R. Co., Washington, Ind., (1947).
W. H. McNairy, Asst. Div. Engr., So. Ry., Charlotte, N. C., (1951).
P. F. McNally, B. & B. Supv., So. Pac. Co., Ogden, Utah, (1948).
H. C. Madson, Designer, C. & N. W. Ry., Chicago, (1940).
C. R. Malmberg, Asst. Supv. B. & B., C. & N. W. Ry., Milwaukee, Wis., (1948).
B. F. Manley, Supv. B. & B., Pac. Elec. Ry. Co., Los Angeles, Cal., (1943).
J. A. Mann, Asst. Supv. M. W. Eqpt., Mo. Pac. R. R., Palestine, Tex., (1948).
D. A. Manning, Supv. B. & B., C. & N. W. Ry., Chicago, (1939).
W. K. Manning, Supv. Brs., Erie R. R., Port Jervis, N. Y., (1948).
R. B. Marshall, Asst. Engr., C. & O. Ry., Richmond, Va., (1949).
W. F. Martens, Gen. For. B. & B., A. T. & S. F. Ry., San Bernardino, Cal., (1924).
G. E. Martin, Supt. W. S., I. C. R. R., Chicago, (1942).
J. U. Martin, Mast .Carp., S. A. L. R. R., Raleigh, N. C., (1946).
T. J. Martin, Gen. Mast. Carp., G. N. Ry., Seattle, Wash., (1940).
E. L. Mason, B. & B. Supv., Mo. Pac. Ry. Co., Kingsville, Tex., (1946).
S. K. Mason, M. of W. Eng., Tex. Mex. Ry., Laredo, Tex., (1950).
W. G. Mateer, Mgr. of Pur. and Stores, E. J. & E. Ry., Chicago, (1944).
R. C. Mathis, Br. Inspr., I. C. R. R., Memphis, Tenn., (1947).
A. N. Matthews, Gen. For. B. & B. & W. S., St. L.-S. F. Ry., Fort Scott, Kans., (1947).
H. A. Matthews, Gen. For. B. & B. & W. S., St. L.-S. F., Memphis, Tenn., (1949).
L. E. May, B. & B. For., A. T. & S. F. Ry., Fresno, Cal., (1948).
L. Mayfield, Res. Engr., M. P. Lines, Houston, Tex., (1944).
J. W. N. Mays, Mast. Carp., Penn. R. R., Pittsburgh, Pa., (1947).
W. R. Meeks, B. & B. Supv., M. P. R. R., Falls City, Nebr., (1942).
W. E. Meredith, Asst. Mast. Carp., Penn. R. R., Harrisburg, Pa., (1950).
B. W. Merrill, Supv. B. & B., N. Y. C. & St. L. R. R., Conneaut, Ohio, (1936).
E. S. Meserve, Asst. Supv. B. & B., B. & M. R. R., Dover, N. H., (1949).
B. R. Meyers, Asst. Ch. Engr., C. & N. W. Ry., Chicago, (1930).
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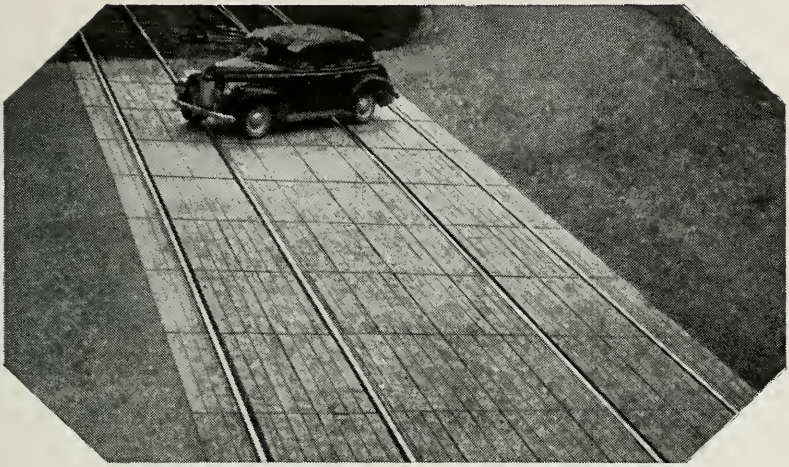

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J. G. Miller, Mast. Carp., B. & O. R. R., Connelsville, Pa., (1948).
R. S. Miller, Bld. Supt., C. R. I. & P. Ry., Chicago, (1949).
H. D. Minnis, Jr., Trk. Supv., So. Ry., Orangeburg, S. C., (1951).
F. M. Misch, Gen. B. & B. Supv., So. Pac. Co., San Francisco, Cal., (1937).
D. N. Mitchell, Asst. Supv. B. & B., C. & O. R. R., Newport News, Va., (1948).
W. Mitchell, Mast. Carp., Penn. R. R., Harrington, Del., (1949).
A. J. Moore, Br. Insp., M. P. R. R., Eunice, La., (1950).
E. W. Moore, Mast. Carp., C. B. & Q. R. R., Centerville, Iowa, (1942).
I. A. Moore, Chief Engr., C. & E. I. R. R., Danville, Ill., (1937).
H. B. Moreland, B. & B. Supv., So. Ry., Wilton, Ala., (1951).
J. H. Morgan, Engr. M. of W., F. E. C. Ry., St. Augustine, Fla., (1948).
L. R. Morgan, Fire Prev. Eng., N. Y. C. R. R., Detroit, Mich., (1937).
E. N. Morin, B. & B. Mast., C. P. R., Farnham, Que., (1946).
W. O. Morris, Supv. W. S., I. C. R. R., Waterloo, Ia., (1947).
R. H. Morrison, Prin. Asst. Engr., B. & A. Ry., Houlton, Me., (1941).
C. A. Moser, B. & B. Supv., Sac. Nor. Ry., Sacramento, Cal., (1951).
C. L. Moser, Supv. B. & B., So. Ry., Asheville, N. C., (1948).
C. H. Mottier, V.-P. & Ch. Eng., I. C. Sys., Chicago, (1942).
R. L. Myers, Supv. W. S., I. C. R. R., Clarksdale, Miss., (1950).

G. W. Neal, Supt., Chattahoochee Valley Ry., West Point, Ga., (1948).
Z. D. Neely, Mast. Carp., B. & O. R. R., Washington, Ind., (1950).
E. I. Nelson, W. S. For., Mo. Pac. Ry., Nevada, Mo., (1948).
R. A. Nelson, Engr. B. & B., C. G. W. R. R., Chicago, Ill., (1948).
O. P. Nicely, Asst. Supv. B. & B., C. & O. Ry., Clifton Forge, Va., (1950).
H. Norris, Asst. Supv. B. & B., F. E. C. Ry., Miami, Fla., (1948).

W. C. Oest, Prin. Asst. Engr., Ft. W. & D. C. Ry. (Burlington), Ft. Worth, Tex., (1947).
V. E. Olson, B. & B. Supv., M. St. P. & S. S. M., Stevens Point, Wis., (1948).
B. J. Ornburn, Asst. Chf. Engr., C. M. St. P. & P. R. R., Chicago, (1948).
T. D. Osbourne, Asst. Gen. Br. Insp., So. Pac. Co., Alhambra, Cal., (1948).
C. N. Overdahl, Asst. B. & B. Supv., N. P. Ry., Tacoma, Wash., (1948).
M. P. Oviatt, B. & B. Supv., C. N. O. & T. P. Ry. (S. P.), Selma, Ala., (1949).
C. Owens, Supv. B. & B., N. Y. O. & W. R. R., Middleton, N. Y., (1948).

***W. H. Pahl, Jr.,** Jr. Eng. B. & B. Dept., Penn. R. R., Pittsburgh, Pa., (1950).
E. Park, Jr., Draftsman, Mo. Pac. Lines, Houston, Tex., (1948).
W. V. Parker, (Retired), Gen. For. B. & B., St. L.-S. W. Ry., Memphis, Tenn., (1911).
E. L. Parrish, B. & B. Supv., I. C. R. R., Vicksburg, Miss., (1947).
H. E. Passel, Div. Engr., B. & O. R. R., Indianapolis, Ind., (1948).
E. Patenaude, B. & B. Mast., C. P. R., Sudbury, Ont., Can., (1930).
R. E. Paulson, Ch. Dftsman., C. M. St. P. & P. R. R., Chicago, (1945).
W. E. Pederson, B. & B. Supv., M. St. P. & S. S. M., Superior, Wis., (1950).
J. M. Peek, Asst. B. & B. Supv., So. Ry., Greenville, S. C., (1951).
J. R. Penhallegon, Asst. Supv. B. & B., C. & N. W. Ry., Chicago, (1940).
L. R. Pennington, B. & B. Supv., C. & N. W. R. R., Chadron, Nebr., (1938).
C. Perry, Asst. Supv. B. & B., C. & O. Ry., Ashland, Ky., (1950).
G. H. Perry, Mast. Carp., Penna. R. R., New York, N. Y., (1948).
J. C. Peterson, Sr. Asst. B. & B. Supv., So. Pac. Co., Sacramento, Cal., (1950).
N. E. Peterson, Engr. M. of W., C. & I. M. Ry., Springfield, Ill., (1938).
W. F. Pettys, Div. Engr., Erie R. R., Youngstown, Ohio, (1948).
L. E. Peyser, Architect, So. Pac. Co., San Francisco, Cal., (1937).
A. Pfeiffer, Asst. B. & B. Supv., So. Pac. Co., Sacramento, Cal., (1939).
C. E. Phelps, B. & B. Supv., Georgia R. R., Camak, Ga., (1948).
B. C. Phillips, Mast. Carp., C. B. & Q. R. R., Alliance, Nebr., (1947).
W. J. Phillips, Asst. Gen. Br. Insp., So. Pac. Co., Berkeley, Cal., (1925).
T. W. Pinard, Ch. Engr., Long Island R. R., Jamaica, N. Y., (1920).
E. J. Plechner, B. & B. Insp., Reading Co., Philadelphia, Pa., (1950).
N. F. Podas, Ch. Engr. St. P. U. D. & Minn. Trans. Co., St. Paul, Minn., (1937).
C. W. Preston, Eng. Pro. Ctgs., B. & O. R. R., Baltimore, Md., (1950).
R. G. Preston, Asst. Engr., Penn. R. R., Chicago, (1947).
G. H. Priest, Gen. For. B. & B., Can. Nat. Ry., Belleville, Ont., Canada, (1948).
C. R. Pritchard, Asst. Arch., So. R. R., Charlotte, N. C., (1948).
W. H. Pryor, Gen. For. B. & B. & W. S., St. L.-S. F. Ry., Memphis, Tenn., (1946).

W. C. Radford, Div. Eng., So. Ry., Richmond, Va., (1951).
W. H. Rainey, Asst. B. & B. Supv., T. & N. O. R. R., San Antonio, Tex., (1947).
W. F. Raley, Mast. Carp., B. & O. R. R., Callery, Pa., (1949).
R. D. Ransom, Div. Eng., C. & N. W. Ry., Antigo, Wis., (1950).
L. F. Rapier, Supv. B. & B., G. M. & O. R. R., Bloomington, Ill., (1946).
A. N. Reece, Asst. to Pres., K. C. S. Ry., Kansas City, Mo., (1922).
A. D. Reed, Mast. Carp., C. B. & Q. R. R., McCook, Nebr., (1945).
C. J. Reed, Supv. B. & B., N. Y. C. Sys., Detroit, Mich., (1949).
F. A. Reed, Supv. B. & B., I. C. R. R., Clinton, Ill., (1947).
A. G. Reese, Dist. Maint. Engr., C. B. & O. R. R., Galesburg, Ill., (1947).
R. F. Reese, B. & B. Supv., T. & N. O. R. R., Houston, Tex., (1950).
E. D. Rice, Br. Insp., C. & E. I. Ry., Danville, Ill., (1949).
C. A. J. Richards, Asst. Mast. Carp., Penna. R. R., Grand Rapids, Mich., (1924).
W. T. Richards, Eng. M. W. & S., W. P. R. R., San Francisco, Cal., (1950).
H. B. Richardson, B. & B. Supv., B. & M. R. R., Dover, N. H., (1948).
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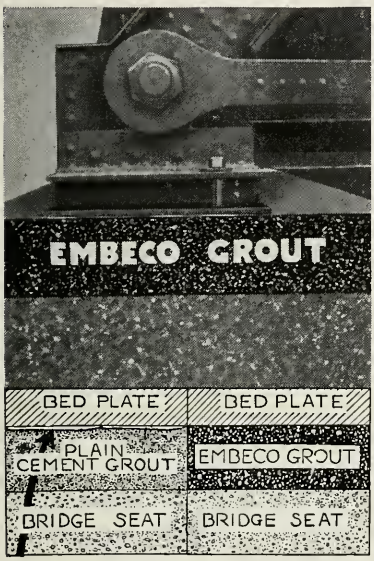

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N. R. Robinson, B. & B. Supv., So. Pac. Co., Sacramento, Cal., (1934).
L. A. Rode, Gen. Br. Insp., Erie R. R., Newark, N. J., (1948).
H. W. Routenberg, Mast. Carp., B. & O. R. R., Baltimore, Md., (1946).
C. E. Russell, Supv. W. S., Ill. Cent. R. R., Chicago, (1944).
G. M. Ryan, B. & B. Supv., N. Y. N. H. & H. R. R., Boston, Mass., (1947).

J. R. Safley, Asst. B. & B. Supv., So. Pac. Co., Dunsmuir, Cal., (1945).
J. M. Salmon, Chief Eng., Clinchfield R. R., Erwin, Tenn., (1938).
C. O. Sathre, B. & B. Supv., C. & N. W. Ry., Norfolk, Nebr., (1950).
T. D. Saunders, Ch. Engr., Ontario Northland Ry., North Bay, Ont., Can., (1930).
W. J. Savage, Asst. Chf. Engr., T. & P. Ry., Dallas, Tex., (1948).
J. H. Sawyer, Jr., Br. Eng., C. G. W. R. R., Chicago, Ill., (1951).
P. J. Scherer, Supv. B. & B., So. Pac. Co., El Paso, Tex., (1936).
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J. C. Schneider, B. & B. Supv., T. & N. O. R. R., Victoria, Tex., (1950).
C. E. Schofield, Asst. Div. Engr., S. A. L. R. R., Savannah, Ga., (1948).
***H. A. Schrader,** Jr. Eng., Penn. R. R., Zionsville, Ind., (1951).
D. E. Schreiber, Fore. W. S., M. P. R. R., Jefferson City, Mo., (1948).
A. W. Schroeder, Supt., C. & E. I. Ry., Danville, Ill., (1949).
P. E. Seites, Asst. Supv. B. & B., C. & O. Ry., Huntington, W. Va., (1950).
R. K. Seals, Trk. Supv., So. Ry., Charleston, S. C., (1951).
L. L. Seley, Mast. Carp., C. B. & Q. R. R., Hannibal, Mo., (1947).
C. M. Setzer, B. & B. Supv., So. Ry., Rock Hill, S. C., (1951).
A. D. Shackelford, Div. Engr., C. N. R., Dauphin, Man., Canada, (1950).
L. A. Shaefer, Fore. W. S., M. P. R. R., Osawatomie, Kan., (1948).
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S. H. Shepley, Asst. Chief Engr., E. J. & E. Ry., Joliet, Ill., (1945).
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W. L. Short, Br. Insp., Mo. Pac. R. R., St. Louis, Mo., (1951).
J. R. Showalter, Br. Engr., M. P. R. R., St. Louis, Mo., (1942).
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H. E. Smith, Engr. M. of W., G. H. & H., Galveston, Tex., (1941).
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F. J. Stewart, Chief Engr., Port Everglades Belt Line Ry., Port Everglades (Ft. Lauderdale), Fla., (1944).
J. H. Stinebaugh, Supv. W. S., I. C. R. R., Carbondale, Ill., (1951).
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J. A. Stronss, Asst. B. & B. Supv., Sou. Pac. Co., Sacramento, Cal., (1934).
J. W. Stutzman, For. Carp., Reading Co., Reading, Pa., (1947).
J. Sumner, W. S. Fore., St. L.-S. F. Ry., Springfield, Mo., (1948).
W. A. Sweet, Gen. Frm. B. & B., A. T. & S. F. Ry., Newton, Kans., (1928).
G. Switzer, Asst. Div. Engr., W. P. R. R., Elko, Nev., (1949).

C. R. Taggart, Supv. B. & B., N. Y. C. Sys., Indianapolis, Ind., (1935).
C. L. Tanner, Gen. For. B. & B. & W. S., P. & S. F., Slaton, Tex., (1948).
E. E. Tanner, Gen. Supv. B. & B., N. Y. C. Sys., Albany, N. Y., (1938).
W. L. Taylor, B. & B. Supv., So. Ry., Jasper, Ala., (1950).
R. S. Templin, For. Carp., Reading Co., Pottsville, Pa., (1947).
L. J. Tetreault, B. & B. For., N. Y. N. H. & H. R. R., Worcester, Mass., (1936).
P. V. Thelander, Asst. Engr. of Mtce., C. & N. W. Ry., Chicago, (1939).
S. R. Thurman, Supv. B. & B., Mo. Pac. R. R., Nevada, Mo., (1943).
D. C. Todd, Mast. Carp., Penna. R. R., Pittsburgh, Pa., (1942).
O. G. Todd, Asst. Div. Engr., B. & O. R. R., Garrett, Ind., (1946).
E. B. Tourtelotte, Supv. B. & B., B. & M. R. R., Greenfield, Mass., (1947).
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H. C. Tunison, Asst. Engr. M. of W., L. & N. E. R. R., Bethlehem, Pa., (1946).
A. E. Tupper, B. & B. For., So. Pac. Co., Stockton, Cal., (1942).
E. F. Turner, For. Steel Constr. Gang, (Sys.) M. K. T. & M. K. T. of T., Denison, Tex., (1950).
J. F. Twomey, Mast. Carp., Penn. R. R., Chicago, (1948).

R. M. Vance, Asst. Sup. B. & B., N. F. & G. (C. & O.), Rainelle, W. Va., (1949).
E. C. Vandenburgh, Chief Engr., C. & N. W. Ry., Chicago, (1925).
R. A. Van Ness, Br. Engr. Sys., A. T. & S. F. Ry., Chicago, (1949).
J. L. Varker, Div. Engr., D. & H. R. R., Carbondale, Pa., (1936).
H. L. Veith, B. & B. Supv., So. Ry., Birmingham, Ala., (1942).
R. E. Ventress, Mast. Carp., G. M. & O. Ry., Springfield, Ill., (1946).
T. M. Von Sprecken, Asst. to Ch. Engr., So. Ry., Washington, D. C., (1938).

R. E. Wait, Supv. B. & B., Wabash R. R., Decatur, Ill., (1923).
C. M. Walker, B. & B. Master, C. N. R., Moncton, N. B., Can., (1949).
G. Walker, Asst. B. & B. Supv., Mo. Pac. Lines, Palestine, Tex., (1941).
G. P. Walker, Supv. B. & B., Mo. Pac. Ry., Monroe, La., (1929).
H. D. Walker, Prin. Asst. Engr., I. C. R. R., Chicago, (1947).
E. G. Wall, Div. Engr., G. M. & O. Ry., Bloomington, Ill., (1942).
R. Wall, Supv. B. & B., So. Ry., Selma, Ala., (1948).
C. E. Wallace, Gen. For. B. & B. & W. S., St. L.-S. F. Ry., Ft. Smith, Ark., (1948).
J. E. Wallace, B. & B. Supv., M. P. R. R., St. Louis, Mo., (1950).
J. A. Walsh, Mast. Carp., Reading R. R., Philadelphia, Pa., (1948).
J. J. Walsh, Mast. Carp., C. B. & Q. R. R., Beardstown, Ill., (1942).
A. B. Wang, Res. Eng., C. I. & L. Ry., Lafayette, Ind., (1950).
J. F. Warrenfells, Mast. Carp., S. A. L. R. R., Savannah, Ga., (1946).
W. M. Warso, Engr., Monongahela Connecting R. R., Pittsburgh, Pa., (1948).
L. W. Watson, Dist. Br. Insp., B. & O. R. R. Co., (Mt. Lebanon) Pittsburgh, Pa., (1944).
H. E. Weatherly, Asst. Div. Eng., T. & N. O. R. R., El Paso, Tex., (1950).
J. E. Weatherly, Sr., Div. Engr., T. & N. O., Houston, Tex., (1950).
G. R. Webber, Ch. Carp., C. M. St. P. & P. R. R., Spokane, Wash., (1948).
D. A. Webster, Track Supv., D. & H. R. R., Whitehall, N. Y., (1950).
T. J. Webster, Mast. Carp., C. R. I. & P. Ry., Kansas City, Mo., (1941).
D. E. Weidner, For. Carp., Reading Co., New Cumberland, Pa., (1947).
J. W. Welch, Supv. B. & B., F. E. C. Lines, St. Augustine, Fla., (1943).
W. M. Wells, Asst. Div. Eng., B. & O. R. R., Washington, Ind., (1946).
O. C. Wentling, B. & B. Inspr., N. Y. C. Lines, Chicago, (1947).
R. A. Westergren, Mast. Carp., Penn. R. R., Baltimore, Md., (1947).
J. W. Westwood, Div. Engr., N. Y. C. Lines, Detroit, (1941).
J. C. White, Div. Engr., N. Y. C. Lines, Indianapolis, Ind., (1947).
L. H. White, B. & B. Supv., Ill. Cent. R. R., Carbondale, Ill., (1946).
S. White, B. & B. Supv., So. Pac. Co., Tucson, Ariz., (1942).
B. M. Whitehouse, Ch. Fire Insp., C. & N. W. Ry., Chicago, (1927).
***F. F. Widrig,** Designer, N. Y. C. Sys., Detroit, Mich., (1949).
A. Wiitala, Gen. For. B. & B., L. S. & I. Ry., Marquette, Mich., (1941).
Wm. Wilbur, Div. Engr., C. & N. W. Ry., Green Bay, Wis., (1947).
C. Williams, Asst. Supv. B. & B., C. & O. Ry., Ashland, Ky., (1950).
N. H. Williams, B. & B. Supv., D. & H. R. R., Oneonta, N. Y., (1947).
R. P. Wilson, Asst. Supv. B. & B., C. & O. Ry., Hinton, W. Va., (1948).
W. E. Wilson, Supv. B. & B., I. R. of C. A., San Salvador, C. A., (1950).
L. C. Winkelhaus, Arch. Eng., C. & N. W. Ry., Chicago, (1934).
F. J. Wirges, Mast. Carp., C. R. I. & P. Ry., El Reno, Okla., (1948).
H. A. Wistrich, Asst. Ch. Engr., L. V. R. R., New York, (1938).
J. P. Witherspoon, Asst. Mast. Carp., S. A. L. R. R., Atlanta, Ga., (1948).
J. E. Wolfe, Steel Br. Insp., M. K. T. of T., Dennison, Tex., (1950).
F. R. Woolford, Ch. Engr., W. P. R. R., San Francisco, Cal., (1950).
H. O. Wray, Engr. M. W. & S., Tex. City Trml. Ry., Texas City, Tex., (1939).
H. Wrights, Supv. B. & B., Mo. Pac. Ry., Little Rock, Ark., (1929).

J. E. Yewell, Chief Engr., B. & L. E. R. R., Greenville, Pa., (1941).

R. O. Zittrouer, Mast. Carp., S. A. L., Atlanta, Ga., (1949).
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W. A. Batey, Con. Engr., U. P. R. R., 4303 South St., Lincoln, Nebr., (1918).
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J. P. Canty, Asst. to Eng. M. W., B. & M. R. R., Melrose, Mass., (1901).
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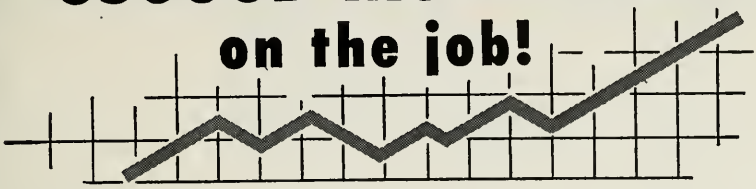

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W. S. Lacher, Sec., A. R. E. A., Chicago, (1922).
W. J. Lacy, Supv. B. & B., M. P. R. R., 4370 Swan St., St. Louis, Mo., (1911).
C. A. Landstrom, Supv. B. & B., C. B. & Q. R. R., 1311 So. 3rd St., Burlington, Iowa, (1928).
H. M. Large, Mast. Carp., Penn. R. R., 511 Geddings Ave., Grand Rapids, Mich., (1908).
H. C. Larsen, Str. Iron Foreman, C. St. P. M. & O. Ry., 1084 Sims Ave., St. Paul, Minn., (1928).
S. Lincoln, Gen. For. B. & B., G. C. & S. F. Ry., 1903 Harrison Ave., Beaumont, Tex., (1927).
C. G. Lindstrom, For. B. & B., C. M. St. P. & P. Ry., Rockwell City, Iowa, (1924).
C. R. Lyman, For. B. & B., Central Vermont Ry., Waterbury, Vt., (1913).

E. M. McCabe, Supv. B. & B., B. & A. R. R., Rte. No. 44, Narragansett Ave., Pittsfield, Mass., (1915).
G. G. McCue, Supv. B. & B., G. T. R. R., 369 Main St., Ottawa, E. Ont., (1913).
H. A. McElhinney, B. & B. Mast., C. N. Ry., 9 Beech St., Haifax, N. S., (1923).
A. G. McKay, Supv. B. & B., N. Y. N. H. & H. R. R., 11 Pine Isand Road, Jupiter Pt., Groton, Conn., (1915).
T. D. McMahon, Architect, G. N. Ry., 223 Lake Ave., White Bear Lake, Minn., (1918).
H. C. McNaughton, Supv. B. & B., B. & M. R. R., Greenfield, Mass., (1915).
F. H. Masters, Chf. Eng., E. J. & E. Ry., 907 Glenwood, Joliet, Ill., (1920).
E. L. Mead, Div. Engr., C. & N. W. Ry., 536 N. E. 69th St., Miami, Fla., (1923).
J. Mellgren, For. W. S., C. & N. W. Ry., 523 N. Caldwell Ave., Eagle Grove, Iowa, (1913).
P. B. Merwin, Asst. Eng., C. & N. W. Ry., Chicago, Ill., (1929).
C. E. Miller, Asst. Engr. M. of W., C. & N. W. Ry., 400 Ridge Ave., Evanston, Ill., (1916).

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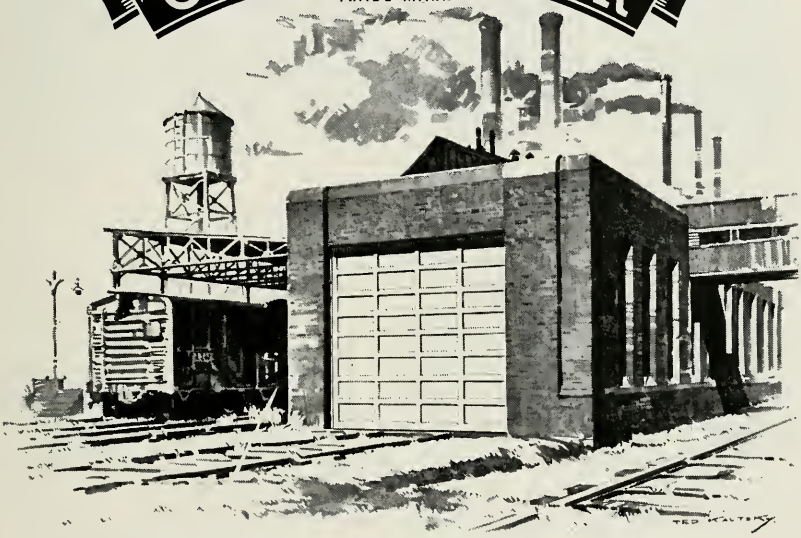

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A. B. Nies, Architect, Mich. Cent. R. R. (N. Y. C.), 408 Third St., Jackson, Mich., (1915).
W. J. O'Brien, Dist. Carp., C. M. St. P. & P. Ry., Necedah, Wis., (1919).
J. A. Owen, For. B. & B., D. & M. Ry., E. Tawas, Mich., (1915).

P. Paulson, Supv. B. & B., C. & N. W. Ry., 547 Simmons Ave., S. E., Huron, So. Dak., (1923).
C. Piccone, Engr. of Brs., Nat. Rys. of Mex., Mont. Everest, 210 Lomas De Chap, Mexico City, Mex., (1923).

D. L. Rehmert, Mast. Carp., Penn. R. R., 376 Chittenden Ave., Columbus, Ohio, (1918).
A. O. Ridgway, Ch. Engr., D. & R. G. W., Olin Hotel, Denver, Colo., (1910).
H. T. Rights, Asst. Brg. Eng., L. V. R. R., 1015 Raymond Ave., Bethlehem, Pa., (1927).
W. R. Roof, Br. Engr., C. G. W. R. R., 7728 Yates Ave., Chicago, (1927).
O. F. Rowland, Asst. Engr., D. & H. R. R., Berkshire Indust. Farm, Canaan, N. Y., (1923).

F. B. Scheetz, Asst. Engr., Mo. Pac. Ry., 3930 Connecticut Ave., Washington, D. C., (1905).
I. L. Simmons, Br. Engr., C. R. I. & P. Ry., Deer Park Inn, Lake Forest, Ill., (1913).
F. M. Sloane, Div. Eng., C. M. St. P. & P. R. R., 1802 N. 59th St., Milwaukee, Wis., (1927).
C. E. Smith, V. P., N. Y. N. H. & H., 282 Prospect St., New Haven, Conn., (1911).
C. U. Smith, Consulting Engr., P. O. Box 953, Lindsay, Cal., (1915).
D. Speaker, Mast. Carp., Penna. R. R., 813 N. 4th St., Steubenville, Ohio, (1928).
H. B. Stuart, Str. Engh., G. T. Ry., 4205 Dorchester St., Westmount, Que., Can., (1913).

J. L. Talbott, Gen. For. B. & B., A. T. & S. F. Ry., Pueblo, Colo., 228 Park St., Morgantown, W. Va., (1905).
E. R. Tattershall, Supv. Mtce. Eqpt., N. Y. C. Sys., 21 Coy St. Malone, N. Y., (1913).
F. A. Taylor, Mast. Carp., B. & O. R. R., 2970 Mattern Ave., Pittsburgh, Pa., (1909).

W. H. Vance, Asst. Engr. M. of W., M. P. R. R., 6347 Alamo Ave., Clayton, Mo., (1910).
E. J. Vincent, For. B. & B., So. Pac. Co., 1740 So. Hoover, Los Angeles, Cal., (1911).
H. Von Schrenk, Const. Tbr. Engr., D. L. & W. Ry., 509 Chouteau Bldg., St. Louis, Mo., (1916).

W. H. Walden, Rdm., Sou. Ry., 1012 Porter St., Richmond, Va., (1920).
L. A. Warren, Supv. B. & B., So. Pac. Co., 4221 Maple St., Sacramento 17, Cal., (1929).
W. Watson, Supv. B. & B., E. J. & E. Ry., 304 Leach Ave., Joliet, Ill., (1930).
F. W. White, Supv. B. & B., L. V. R. R., 409 S. Wilbur Ave., Sayre, Pa., (1915).
W. E. White, Gen. For., A. T. & S. F. Ry., Chanute, Kans., (1920).
J. J. Wishart, Supv. B. & B., N. Y. N. H. & H., 21 Elmlawn Rd., Braintree, Mass., (1915).
C. F. Womeldorf, Div. Engr., C. & N. W. Ry., 111 No. 12th St., Norfolk, Nebr., (1917).
C. W. Wright, Mast. Carp., L. I. R. R., 67 Nassau Parkway, Oceanside, N. Y., (1908).
H. Wuerth, Div. Engr., C. M. St. P. & P. R. R., Savanna, Ill., (1919).

E. C. Zinmeister, Mast. Carp., B. & O. R. R., 312 Tenth St., N., St. Petersburg, Fla., (1905).

HONORARY MEMBERS

A. E. Bechtelheimer, (Retired) Br. Engr., C. & N. W. Ry., Chicago, (1920).
Ralph Budd, (Retired) Chf. Exec. Off., C. B. & Q. R. R., Chicago, (1927).
Charles H. Buford, (Retired) Pres., C. M. St. P. & P. Ry., Chicago, (1946).
C. E. Johnston, (Retired) Chairman, West. Assoc. Ry. Ex., LaJolla, Cal., (1911)
T. H. Strate, (Retired) Div. Engr., C. M. St. P. & P. R. R., Chicago, (1918).

ASSOCIATE MEMBERS

L. Adams, Oxweld Railroad Service Co., 230 N. Michigan Ave., Chicago, (1943).
J. H. Allen, Fld. Engr. Fin. Div., E. I. DuPont de Nemours & Co., Briar Hill, Malvern, Pa., (1949).
W. P. Arnold, Asst. to V.-P., (Wood Preservg. Div.) Koppers Co., Inc., Pittsburgh, Pa., (1946).

G. H. Bailey, Mgr. R. R. Div., Morrison-Knudsen Co., 1718 No. 15th St., Boise, Idaho.
D. L. Baker, V.-P., Baker & Hickey Co., P. O. Box No. 5008, Tri Village Sta., Columbus 12, Ohio, (1946).

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A. E. Bardwell, West. Div. Mgr., Fabreeka Products Co., 325 W. Huron St., Chicago 10, Ill., (1946).
R. H. Bescher, Mgr. of Tech. Dept., Wood Pres. Div., Koppers Co., Inc., Koppers Bldg., Pittsburgh, Pa., (1948).
G. R. Betts, Mgr. R. R. Sales, Armco Drainage & Metal Prod., Inc., 310 S. Michigan Ave., Chicago, (1946).
D. B. Bishop, Sales Eng., Dearborn Chemical Co., 1512 Farmers Bank Bldg., Pittsburgh, Pa., (1946).
A. Boldt, Cont. Lum. Sales, No. 2 W. Cutting Boul., Richmond, Cal., (1949).
J. D. Bolton, J. D. Bolton & Co., 910 Custer Ave., Evanston, Ill., (1946).
Chas. H. Borcherding, Sr., Field Engr., The Master Builders Co., 13 W. 25th St., Baltimore 18, Md., (1947).
C. R. Boulton, R. R. Contractor, 15 E. Town St., Columbus, Ohio, (1946).
L. D. Brennon, M. W. Rep., Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y., (1950).
C. E. Bryant, Jr., Johns-Manville Sales Corp., 22 E. 40th St., New York, N. Y., (1951).
J. P. Burkey, Con. Engr., Union Metal Mfg. Co., 2421 Plymouth Ave., Columbus, Ohio, (1942).
G. C. Buskirk, Repr., Pacific Borax Co., 5012 Cedar Ave., S., Minneapolis 17, Minn., (1949).

J. F. Canning, V. P., Southwestern Petroleum Co., P. O. Box 789, Ft. Worth, Tex., (1949).
K. J. Clapp, Asst. Sales Mgr., Homelite Corp., Port Chester, N. Y., (1946).
R. Clarke, Res. Mgr., Massey Conc. Prod. Co., 111 W. Washington St., Chicago, (1948).
H. S. Claybaugh, Div. Engr., Armco Drainage & Metal Prod., Inc., 4345 Lyndale Ave., Minneapolis, Minn., (1946).
R. R. Clegg, Dist. Sales Mgr., American Lumber & Treating Co., 332 S. Michigan Ave., Chicago, (1946).
M. Coburn, (Retired), 4117 Park Ave., Indianapolis 5, Ind., (1946).
C. M. Colvin, Constr. Supt., Armco Drainage & Metal Products, Inc., 7th & Parker Sts. Berkeley, Cal., (1945).
E. T. Cross, V.-P., Armco Drainage & Metal Products, Inc., Middletown, Ohio, (1946).
J. A. Crowe, Mgr., Bird Tie Pads, Bird & Son, Inc., East Walpole, Mass., (1951).
T. D. Crowley, Pres. Thos. D. Crowley & Co., 37 S. Wabash Ave., Chicago, (1946).

V. W. Davis, Mgr. R. R. Sales, Armco Drainage & Metal Prod., Inc., P. O. Box 1343, Atlanta, Ga., (1946).
G. E. Detzel, George E. Detzel Co., 2303 Gilbert Ave., Cincinnati, Ohio, (1945).
G. J. Diver, V. P., Morrison Ry. Supply Corp., 814 Rand Bldg., Buffalo, N. Y., (1946).
F. J. Duffie, Gen. Supvr., Oxweld Railroad Service Co., 230 N. Michigan Ave., Chicago, (1946).
W. D. DuLac, Dist. Mgr., Pittsburgh Pipe Cleaner Co., 544 New Center Bldg., Detroit, Mich., (1945).

C. R. Ehni, Prod. Engr., The Texas Co., 1509 S. 59th St., Kansas City, Kans., (1950).
L. T. Ericson, Ch. Engr., The Jennison Wright Corp., Toledo, Ohio, (1948).
H. Eschenbrenner, Pres., Universal Concrete Pipe Co., 36 Ashbourne Rd., Columbus, Ohio, (1946).
F. W. Evinger, R. R. Repr., The Patterson Sargent Co., 1882 S. Normal Ave., Chicago, (1946).

J. D. Faylor, Div. Engr., Armco Drainage & Metal Prod., Inc., 444 Insurance Exchange Bldg., Des Moines, Iowa, (1946).
P. Fields, Sales Div., Detroit Graphite Co., 3228 N. Broadway, St. Louis, Mo., (1946).
A. J. Filkins, Pres., Filkins & Sons, 9 So. Clinton St., Chicago, (1927).
F. Fix, Sales Mgr. Transp. Dept., Cent. Div., Johns-Manville Sales Corp., 1530 Guild Hall Bldg., Cleveland, Ohio, (1946).
L. Flanagan, Detroit Graphite Co., 1500 S. Western Ave., Chicago, (1937).
R. L. Fletcher, Strl. Engr., Timber Engineering Co., 1319—18th St., N. W., Washington, D. C., (1947).
L. E. Flinn, Sls. & Serv. Repr., Dearborn Chemical Co., Merchandise Mart, Chicago, Ill., (1949).
E. A. Fox, Dist. Mgr., The Master Builders, 80 Boylston St., Boston, Mass., (1951).
H. Z. Frederick, Mgr. Ry. Sales Div., The R. C. Mahon Co., Detroit 11, Mich., (1950).

J. L. Gibboney, Asst. Vice Pres., National Aluminate Corp., 4042 Kessler Bl., Indianapolis, Ind., (1949).
I. L. Glassgold, President, Masonry Resur. & Con. Co., Inc., B. & O. Coal Pier, Baltimore, Md., (1950).
L. E. Goerder, Supt., George Vang, Inc., R. R. Contractors, 623 Grant Bldg., Pittsburgh, Pa., (1946).

E. H. Harder, General Contractor, 809 Page St., Berkeley, Cal., (1950).
H. F. W. Hauslein, H. Hauslein & Associates, 221 N. La Salle, Chicago, (1948).
W. R. Hedden, Gen. Supt. of Constr., Roberts & Schaefer Co., 130 N. Wells St., Chicago, Ill., (1946).
J. F. Hickey, Pres., Baker & Hickey Co., P. O. Box No. 5008, Tri Village Sta., Columbus 12, Ohio, (1946).

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W. N. Hoelzel, Sls. Gary Screw & Bolt Div., Pittsburgh Screw & Bolt Corp., 122 S. Michigan Ave., Chicago, Ill., (1949).
T. E. Hoffman, Div. Mgr. & Fire Pro. Supv., The Zone Co., 917 N. Main St., Ft. Worth, Tex., (1949).
F. W. Holstein, Mech. Engr., The Rails Co., 115 Observer Highway, Hoboken, N. J., (1948).
W. S. Hopkins, Jr., M. of W. Repr., Air Reduction Sales Co., Garrett, Ind., (1949).
R. R. Howard, Cent. Div. Mgr., Fabreeka Products Co., Inc., 6432 Cass Ave., Detroit, Mich., (1946).
D. A. Hultgren, Pres., David A. Hultgren Co., 80 E. Jackson Blvd., Chicago, (1945).

A. E. Jacobson, Asst. to Mgr., Oxweld Railroad Service Co., 230 No. Michigan Ave., Chicago, Ill., (1950).
E. S. Joehnk, c/o F. K. Ketler Co., 327 So. La Salle St., Chicago, Ill.
H. E. Johnston, Mgr. No-Ox-Id Dept., E. Div., Dearborn Chemical Co., 205 E. 42nd St., New York, (1947).

J. E. Kalinka, Vice-Pres., Roberts & Schaefer Co., 130 N. Wells St., Chicago, Ill., (1946).
B. D. Keatts, Reg. V.-P., Intrusion-Prepakt, Inc., 746 Union Commerce Bldg., Cleveland, Ohio, (1946).
R. S. Kiester, Sls., Pacific Coast Borax Co., 503 So. Standard Bldg., Houston 2, Tex., (1950).
M. G. Kirk, Sales, Pittsburgh Screw & Bolt Corp., Box 1708, Pittsburgh, Pa., (1948).
F. H. Kuhlmann, Dist. Mgr., Dearborn Chemical Co., 1218 Oliver St., St. Louis, Mo., (1946).

J. W. Lacey, Gen. Supvr., The Oxweld Railroad Service Co., 230 N. Michigan Ave., Chicago, (1946).
C. L. LeDue, Field Sales Mgr., Acorn Refining Co., Cleveland, Ohio, (1946).
R. H. Lee, Pres., George Vang, Inc., Pittsburgh, Pa., (1951).
F. Leypoldt, Jr., Pres., Carbolineum Wood Preserving Co., 528 W. Highland Ave., Milwaukee, Wis., (1945).
W. P. Lipscomb, Mgr. R. R. Sls., Armco Drainage & Metal Prod., Inc., 3524 Plumb St., Houston 5, Tex., (1951).
E. J. Littleton, Mgr. R. R. Sales, Jennison-Wright Corp., Granite City, Ill., (1948).
E. P. Lockart, Mgr. Glass Blk. Sls., American Structural Prod. Co., P. O. Box No. 1035, Toledo, Ohio, (1951).
J. S. Loeffler, Sales Engineer, Armco Drain. & Metal Prod., Inc., 4345 Lyndale Ave., N. Minneapolis, Minn., (1948).
L. A. Luther, Serv. Engr., Ingersoll-Rand Co., 1121 Hamilton, Palo Alto, Cal., (1945).
C. A. Lyon, Dist. Mgr., Master Builders Co., 228 N. La Salle St., Chicago, (1945).

W. L. McDaniel, V.-P., Massey Concrete Products Co., 111 W. Washington St., Chicago, (1945).
E. C. McFadden, Dist. Mgr., Pittsburgh Pipe Cleaner Co., 11110 Longwood Dr., Chicago 43, (1945).
E. J. McGehee, Vice-Pres., Koppers Co., Inc., 122 So. Michigan Ave., Chicago 3, Ill., (1946).
C. A. McTaggart, State Sales Mgr., No. & So. Dak., Armco Drainage & Metal Products, Inc., 705 National Bank Bldg., Sioux Falls, So. Dak., (1946).
G. McVay, Mgr. R. R. Sales Div., The Ruberoid Co., 307 N. Michigan Ave., Chicago 1, Ill., (1937).
D. B. Mabry, Mgr. Lbr. Sales, T. J. Moss Tie Co., 700 Security Bldg., St. Louis, Mo., (1948).
C. L. Martin, c/o H. P. Martin & Sons, Box 475, Owensboro, Ky., (1946).
Mayfield, P. B., Tech. Consult., Barrett Div., Allied Chem. & Dye Corp., 40 Rector St., New York 6, N. Y., (1950).
C. V. Mero, Mastercraft Tile & Roofing Co., No. 1 20th St., Richmond, Calif., (1949).
F. J. Meyer, Ch. Engr., Ry. Prod. Div., Phila. Steel & Wire Corp., 9 S. Clinton St., Chicago, Ill., (1948).
J. Wallace Miller, Pres., W-M Corp., 608 S. Dearborn St., Chicago, (1946).
J. H. Minton, The Minton Construction Co., 3715 Prospect Ave., Cleveland, Ohio, (1???).
H. Montgomery, Dist. Mgr., The Master Builders Co., 2159 Bay St., Los Angeles, Calif., (1946).
Z. J. Montgomery, Arco Co. of California, Ltd., 745 E. 59th St., Los Angeles, Calif., (1945).
G. J. Morris, Dist. Engr., Electric Tamper & Equip. Co., P. O. Box No. 5, Cambridge, Ohio, (1948).
H. M. Morton, Sales Eng., R. R. Div., Johns-Manville Corp., 1267 Architects Bldg., Los Angeles, Calif., (1945).
H. Mull, V.-P. Sales, Warren Tool Corp., 1821 Bankers Bldg., Chicago, (1946).
J. K. Murdock, Vice-Pres., The Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati, Ohio, (1946).

L. H. Needham, Vice-Pres., The Penetryn System, Inc., 2294 Scranton Rd., Cleveland, Ohio, (1946).
W. L. Norman, Field Engr., Joy Mfg. Co., 2900 Santa Fe Ave., Los Angeles, Calif., (1949).

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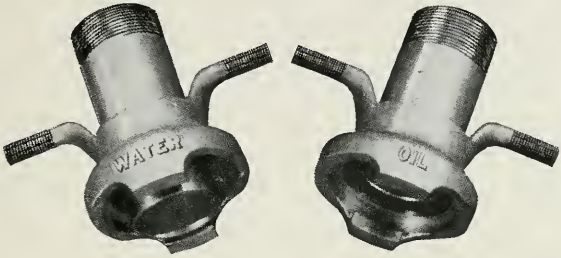

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G. H. Paris, R. R. Rep., Strl. & Rys. Bur., Portland Cement Assoc., 33 W. Grand Ave., Chicago, (1945).
R. Patterson, Vice Pres., Instrusion Prepakt, Inc., 80 E. Jackson Blvd., Chicago 4, (1946).
D. D. Powers, Sales Engr., Dearborn Chemical Co., 1101 Union Central Bldg., Cincinnati 2, Ohio, (1947).

C. C. Ransch, Asst. Vice-Pres., Dearborn Chemical Co., Merchandise Mart, Chicago, (1945).
G. H. Redding, Pres., Massey Concrete Products Co., 122 S. Michigan Ave., Chicago, (1946).
W. T. Reeves, Const. Engr., Strl. Steel Dept., Robert W. Hunt Co., 172 W. Jackson Blvd., Chicago, (1924).
H. E. Robertson, Mgr., The H. E. Robertson Co. Inc., 730 E. Gage Ave., Los Angeles, Calif., (1946).
W. O. Robertson, Div. Sales Engr., Armco Drainage & Metal Prod., Inc., Box 1657, Baltimore, Md., (1946).
H. J. Roth, Sales Engr., Buda Co., 492 S. Marion Parkway, Denver, Colo., (1947).
D. A. Ruhl, Sales Engr., Tbr. Structs., Inc., 120 S. La Salle, Chicago, Ill., (1948).

J. M. Scott, The Arco Co., 614 Delaware St., Scranton, Penna., (1945).
J. W. Shoop, Vice Pres., The Lehon Co., 4425 S. Oakley Ave., Chicago, (19??).
F. C. Smith, R. R. Fire Protect. Engr., Marsh & McLennan, Inc., 231 So. La Salle St., Chicago, Ill., (1948).
Smith, K. A., Dist. Mgr., Armco Drainage & Metal Prod., Inc., 7th and Parker, Berkeley, Calif., (1950).
Smith, W. T., Gen. Supt., Geo. E. Detzel Co., 2303 Gilbert Ave., Cincinnati, Ohio, (1950).
B. S. Snow, Pres., T. W. Snow Construction Co., 9 S. Clinton St., Chicago, (1946).
C. E. Southwick, Factory Repr., Homelite Corp., (Port Chester, N. Y.), 624 S. Anderson, Los Angeles, Calif., (1945).
Spietz, A. L., Pres., Interstate Gen. Contractors, Inc., 5621 N. Glenwood Ave., Chicago 40, Ill., (1950).
Spietz, W. P., Monarch Painting Service, 5621 N. Glenwood Ave., Chicago 40, Ill., (1950).
G. W. Stierer, Mgr., Structural Steel Dept., Robert W. Hunt Co., 175 W. Jackson Blvd., Chicago, (1946).

N. Thompson, V.-P., Homelite Corp., Port Chester, N. Y., (1946).
R. N. Tracy, Div. Engr., Armco Drainage Metal Products, Inc., P. O. Box No. 2170, Denver 1, Colo., (1946).
F. W. Truss, Mgr. R. R. Sales, Armco Drainage & Metal Products, Inc., 817 Ambassador Bldg., St. Louis, Mo., (1946).

O. H. Utley, Sales Mgr., The Zone Co., Div. of Southwestern Petroleum Co., 1917 N. Main St., Fort Worth, Tex., (1949).

R. G. VandenBoom, Pres., Pacific Union Metal Co., 3248 Long Beach, Ave., Los Angeles, Calif., (1946).

R. Wagner, Roberts & Schaefer Co., 301 N. Michigan Ave., Chicago, (1946).
W. R. Walters, Gen. Mgr., Railway Ballast Cond. Corp., 1460 Rand Tower, Minneapolis, Minn., (1949).
K. J. Weir, W-M. Corporation, 680 S. Dearborn St., Chicago 5, (1940).
B. E. Whipple, Sales Eng., Pacific Union Metal Co., P. O. Box 2616, Term. Annex, Los Angeles, Calif., (1946).
F. T. Winters, Jr., Mgr. Weed Control Div., Pacific Coast Borax Co., Los Angeles, Calif., (1946).
B. R. Wood, c/o The Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio, (1937).

R. W. Young, Jr., R. W. Young Mfg. Co., 20 N. Wacker Dr., Chicago, (1946).

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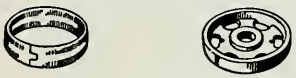

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*Bird & Son, Inc., East Walpole, Mass.

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*National Lead Company, New York

Overhead Door Corporation, Hartford City, Ind.
*Oxweld Railroad Service Division, Chicago

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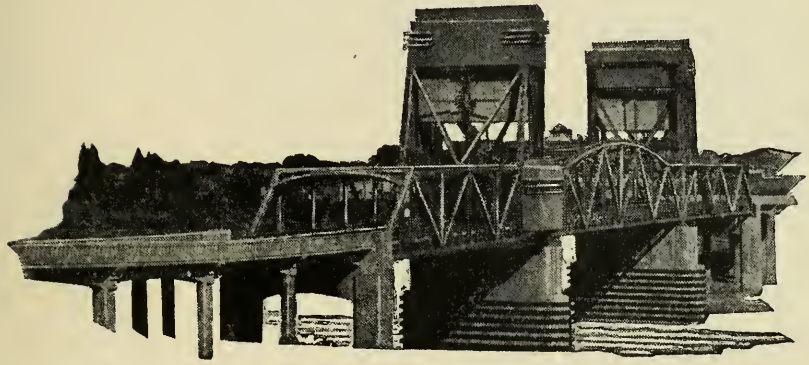

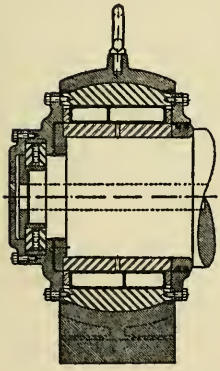

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